

SIGNAL SECTION ADVANCE NOTICE

ASSOCIATION OF AMERICAN RAILROADS

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REPORTS

to be presented at the

Fifty-Fifth Annual Meeting

ST. LOUIS, MO.

September 28, 29 and 30, 1953

RULES OF ORDER

RESULT OF 1952 LETTER BALLOT

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ASSOCIATION OF AMERICAN RAILROADS
SIGNAL SECTION

COMMITTEE REPORTS

1952 Fiscal Year

(October 1, 1952—September 30, 1953)

Fifty-Fifth Annual Meeting

Chase Hotel

St. Louis, Mo.

September 28, 29 and 30, 1953

ASSOCIATION OF AMERICAN RAILROADS

OPERATIONS AND MAINTENANCE DEPARTMENT

ENGINEERING DIVISION

Signal Section

Office of the Secretary, 59 East Van Buren Street, Chicago 5, Ill.

J. H. AYDELOTT
VICE-PRESIDENT
Operations and Maintenance
Department

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H. A. Hudson, Southern Ry., Chairman.
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W. S. Storms	E. A. Warner*

Signal Section, A.A.R.:

The following outline of work has been assigned:

1. Revision of Manual.
2. Indexing signal literature.
3. Report on the economics of railway signaling.

The Committee submits for consideration, reports on the following subjects**:

3. Costs involved in stopping trains.

Economics of signal indication operation on single-track line, with 9 to 15 trains per day, on the Chicago, Burlington & Quincy R.R., Ravenna to Alliance, Nebr.

Economics of automatic and auto-manual controlled highway crossing protection devices.

Effect of various classes of track on taxation.

Train hour value.

Track and roadway maintenance expenses—per equated track mile.

Economics of minimizing track circuit rail bond failures.

Operating advantages of centralized traffic control replacing multiple remote control train operation by signal indication, Grafton to Parkersburg, W. Va., on the Baltimore & Ohio R.R.

Economics of signaling for expediting traffic through yards.

† Deceased April 25, 1953.

* Consulting Member.

** Suggestions or criticisms should be submitted in writing to the Chairman of the Committee on or before August 28, 1953.

COSTS INVOLVED IN STOPPING TRAINS

*Simplified Method of Determining Increased Fuel Consumption and
Time Lost in Making Stop**Introductory.*

Previous reports have been presented on costs involved in stopping trains, the last report appearing in A.A.R. Signal Section 1950 Proceedings, Vol. XLVIII, pp. 7 and 388.

The reports have never been questioned nor are they now questioned as to their being a fairly accurate method for determining the cost of fuel involved in a train stop; however, as simple as the reports, charts and formulae are there has been a demand for some still further short-cut method of arriving at cost of fuel figures.

To satisfy this demand there is presented herewith a solution of the problem which will provide a reasonable approximation of the cost figure that would be determined were the methods outlined in the 1951 report used.

1. It can be assumed that stopping a Diesel-propelled freight train operating on level tangent track at full capacity of the locomotive will cause an increase in fuel consumption of approximately 5 per cent of the full load hourly rate and a delay of about 5 minutes excluding the stop period.
2. It can be assumed that stopping a Diesel-propelled freight train operating on level tangent track at 75 per cent of full capacity (87 per cent of maximum balanced speed) will cause an increase in fuel consumption of approximately 4 per cent of the full load hourly rate and a delay of about 4 minutes excluding the stop period.
3. It can be assumed that stopping a Diesel-propelled freight train operating on level tangent track at 50 per cent of full capacity (70 per cent of maximum balanced speed) will cause an increase in fuel consumption of approximately 3 per cent of the full load hourly rate and a delay of about 3 minutes excluding the stop period.

Note.—The full load hourly consumption should be based on the full load rating of the total locomotive plus auxiliaries which may be taken at 4 to 7 per cent of the power available for traction.

In all cases the fuel consumption while standing can be taken at 1 per cent of the full load hourly consumption for each 6 minutes of standing time.

Examples:

1-a Assume a 4-unit Diesel locomotive working full capacity.

Full capacity fuel consumption (allowing for auxiliaries)

100 gallons per hour per unit

Full capacity fuel consumption 4 units = 400 gallons per hour

5 per cent of 400 gallons = 20 gallons

Fuel consumption standing 6 minutes = 1 per cent of 400 = 4 gallons

Sept. 1953]

Com. I—Economics of Ry. Signaling

Total fuel consumed due to train stop equals

20 gallons + 4 gallons = 24 gallons

24 gallons @ \$.10 per gallon = \$2.40 cost of stop

2-a Assume a 4-unit Diesel locomotive working 75 per cent full capacity.

Full capacity fuel consumption (allowing for auxiliaries)

100 gallons per hour per unit

Full capacity fuel consumption 4 units = 400 gallons per hour

4 per cent of 400 gallons = 16 gallons

Fuel consumption standing 6 minutes = 1 per cent of 400 = 4 gallons

Total fuel consumed due to train stop equals

16 gallons + 4 gallons = 20 gallons

20 gallons @ \$.10 per gallon = \$2.00 cost of stop

3-a Assume a 4-unit Diesel locomotive working 50 per cent full capacity.

Full capacity fuel consumption (allowing for auxiliaries)

100 gallons per hour per unit

Full capacity fuel consumption 4 units = 400 gallons per hour

3 per cent of 400 gallons = 12 gallons

Fuel consumption standing 6 minutes = 1 per cent of 400 = 4 gallons

Fuel consumed due to train stop equals

12 gallons + 4 gallons = 16 gallons

16 gallons @ \$.10 per gallon = \$1.60 cost of stop

Action Recommended

Acceptance as information.

ECONOMICS OF SIGNAL INDICATION OPERATION ON SINGLE-
TRACK LINE, WITH 9 TO 15 TRAINS PER DAY, ON THE
CHICAGO, BURLINGTON & QUINCY R.R., RAVENNA
TO ALLIANCE, NEBR.

In March 1951, the Chicago, Burlington & Quincy R.R.* completed a system of centralized traffic control designed to meet the operating requirements on 238 miles of single track between Ravenna and Alliance, Nebr., on the route between Chicago, Ill. and Billings, Mont., via Omaha and Lincoln, Nebr.

The traffic is light, 9 to 15 trains per day, and consists of 4 scheduled passenger trains, 4 scheduled freight trains, 1 local freight train (3 days per week), 1 extra freight train of mostly loaded oil cars, and during the autumn months about 4 extra freight trains of loaded stock cars. The scheduled freight trains are hauled by Diesel locomotives, and the other trains by steam locomotives.

Previously, train operation was by time-table and train orders. All switches were hand-thrown. No signal system was in service.

Except for a few breaks, the grade ascends gradually westward, the maximum being 0.6 per cent. The grade descends gradually eastward, except for about 4 miles of 0.5 per cent ascending. The length of sidings limits the number of cars in a train and this indirectly limits the tonnage rather than being limited by the grades.

The maximum permissible speed is 65 miles per hour for passenger trains and 50 miles per hour for freight trains. The locomotives can handle trains consistently at these speeds in either direction.

The preponderance of loaded cars move eastward, including cars of agricultural products, live stock, oil and lumber. Westward traffic includes merchandise and manufactured products, and empty oil and stock cars. Eastward trains are given preference.

Sidings at seven locations were left in place, although not equipped with C.T.C. control, some of which were shortened and used as storage and business tracks. Sidings at two locations were removed. A new 130-car siding was constructed midway between the two points where the old sidings were removed. Thus, there are now 22 centralized traffic control equipped sidings, as compared with 31 sidings previously. Sidings not already long enough were lengthened; capacity varies between 128 and 158 cars—40,086 feet of track were removed and 37,048 feet installed.

Short spurs, house tracks, and stock pen tracks are located at all the towns. The hand-throw stands at these 44 main track switches were left in service, and electric locks added as part of the centralized traffic control system.

Power switch machines and a complete complement of C.T.C. controlled signals were installed at both ends of the terminals at Ravenna and Alliance, as well as at Seneca, Nebr., which is the midpoint at which freight trains stop to change crews. Power switch machines were installed at both ends at one other point where there is heavy switching.

At the remaining 18 locations, there is a power switch machine and a complete complement of controlled signals at one end of the siding, and a spring switch and a controlled dwarf signal at the other end.

At 15 of these 18 locations, the power switch machine is at the east end of the siding in order that a westward train can enter the siding without stopping

* *Railway Signaling and Communications*, November 1951, p. 774.

and thus quickly clear the main for the eastward preference train. At the other three locations the power switch machine is at the west end to facilitate movement of eastward trains out of the terminal and clear the yard.

At Alliance, the centralized traffic control system includes power switch machines and signals at the east end yard entrance, and at the west end of the yard, two crossovers and signals at a junction of two lines, one west to Billings and the other south to Denver, Colo.

In general, trains enter a siding at the power switch end and depart at the spring switch end; however, the signaling is so arranged that the dispatcher can, by signal indication, direct a train to enter at the spring switch if he decides that train time can be saved thereby.

Opposing train movements are blocked from one power switch to the next power switch. Intermediate signals are provided to facilitate following movements.

Passenger and freight train movements have been accelerated by this signal system. Of particular interest is the elimination of a bottleneck which occurred shortly after midnight involving one passenger and one manifest freight train in each direction. The dispatcher has been able to expedite the movement of these four priority trains an average of 40 minutes each. In addition, extra trains save more than an hour each because of ability to quickly change meeting and passing points as operating requirements dictate.

Other savings include safety in train operation and the release of personnel for duties elsewhere.

Economic Statement

1. Cost of Installation:

(a) Capital Investment:

Signaling.....	\$1,404,320
Track.....	277,377
Total.....	\$1,681,697

(b) Operating Expenses:

Signaling.....	\$ 18,523
Track.....	170,837
Total.....	189,360

(c) Total.....

\$1,871,057

2. Gross Saving per Annum.....

\$ 358,466

3. Increased Annual Operating Expenses:

Depreciation (3% of 1-a, Signaling).....	\$ 42,130
Maintenance and Operation of Signal System.....	18,999
Total.....	61,129

4. Net Reduction in Annual Operating Expenses.....

\$ 297,337

5. Deduction for Interest Charges @ 3% (of 1-a).....

50,451

6. Net Saving per Annum.....

\$ 246,886

7. Annual Return over 3% Interest:

(a) On Capital Investment ($6 \div 1-a$).....	14.7%
(b) On Total Cost ($6 \div 1-c$).....	13.2%

Action Recommended

Acceptance as information.

ECONOMICS OF AUTOMATIC AND AUTO-MANUAL CONTROLLED
HIGHWAY CROSSING PROTECTION DEVICES*

ILLINOIS CENTRAL R. R.

During 1951 the Illinois Central R.R. completed improvements in protection at 13 street crossings in Memphis, Tenn. Seven of these crossings are protected by automatic flashing light signals, and six crossings are protected by auto-manual flashing light signals with short-arm gates and "No Turn" signs.

Prior to this modernization, 25 watchman tricks were required to handle the 13 crossings. With the new arrangement three watchman tricks are required.

The six crossings provided with gates and "No Turn" signs in addition to flashing light signals are located in a river-front park area adjacent to the Memphis business district. Because of the heavy volume of both rail and vehicle traffic, manual supervision of the crossing protection operation was provided for these six streets, although the normal controls are fully automatic. This manual supervision is accomplished from an illuminated control panel in a new control tower located near the center of this group of streets. The architecture of the control tower was designed to blend with its background of parks and public buildings.

At various points within the limits of this installation, the center sections of switching tracks paralleling Illinois Central tracks belonging to the St. Louis-San Francisco Ry., Louisville & Nashville R.R., Missouri Pacific R.R. and the Union Ry., were included in the protection. The mentioned roads were therefore involved in the expense of this installation to a slight degree.

Economic Statement

1. Cost of Installation:	
(a) Capital Investment.....	\$157,357
(b) Operating Expenses.....	10,369
(c) Total.....	\$167,726
2. Gross Saving per Annum.....	\$119,334
3. Increased Annual Operating Expenses.....	16,146
4. Net Reduction in Annual Operating Expenses.....	\$103,188
5. Deduction for Interest Charges @ 6% (of 1-a).....	9,441
6. Net Saving per Annum.....	\$ 93,747
7. Annual Return over 6% Interest:	
(a) On Capital Investment ($6 \div 1-a$).....	59.5%
(b) On Total Cost ($6 \div 1-c$).....	55.2%

* Previous report on this subject appears in A.A.R. Signal Section 1949 Proceedings, Vol. XLVII, pp. 20 and 318.

ST. LOUIS-SAN FRANCISCO RY.

Flashing light type signals have been installed at 12 street crossings on the St. Louis-San Francisco Ry. through Birmingham, Ala. in place of watchmen. Traffic on this section of line consists of passenger and switching movements which are made at slow speed. The signals are arranged for automatic operation and are controlled by short track circuits.

Economic Statement

1. Cost of Installation:	
(a) Capital Investment.....	\$70,905
(b) Operating Expenses.....	1,750
(c) Total.....	<u>\$72,655</u>
2. Gross Saving per Annum.....	\$92,000
3. Increased Annual Operating Expenses.....	2,300
4. Net Reduction in Annual Operating Expenses.....	\$89,700
5. Deduction for Interest Charges @ 6% (of 1-a).....	4,254
6. Net Saving per Annum.....	<u>\$85,446</u>
7. Annual Return over 6% Interest:	
(a) On Capital Investment ($6 \div 1-a$).....	120.5%
(b) On Total Cost ($6 \div 1-c$).....	117.6%

Summary of Advantages

1. Dependable 24-hour operation.
2. Uniform and more effective type of protection.
3. Increased safety for both street traffic and train operation.
4. Reduction of operating expenses.

Action Recommended

Acceptance as information.

EFFECT OF VARIOUS CLASSES OF TRACK ON TAXATION

At the 1952 Annual Meeting† the Committee submitted a report on this subject and presented Table I for the calendar year 1950. A revision of Table I for the calendar year 1951, which brings the information up-to-date with the latest available figures, is presented herein. As shown in Table I, State and Local taxes per mile of track operated varied from a minimum of \$189 to a maximum of \$4,353, with a composite average for the 78 railroads, of \$916. This information has been developed through cooperation with the Bureau of Railway Economics, A.A.R.

TABLE I
State and Local Taxes per Mile of Track Operated
Calendar Year 1951

Railroad	Total miles of all track operated at close of year	State and local taxes*	
		Total	Per mile of track operated
NEW ENGLAND REGION:			
1 Bangor & Aroostook.....	872.87	\$632,263	\$724
2 Boston & Maine.....	3,231.63	2,954,435	914
3 Central Vermont.....	612.22	159,322	260
4 Maine Central.....	1,326.23	929,144	701
5 New York, New Haven & Hartford.....	4,230.40	5,711,245	1,350
6 Rutland.....	522.67	152,033	291
GREAT LAKES REGION:			
7 Ann Arbor.....	418.44	234,195	560
8 Delaware & Hudson.....	1,731.98	1,819,952	1,051
9 Delaware, Lackawanna & Western.....	2,408.94	4,388,945	1,822
10 Erie (Incl. Chgo. & Erie).....	5,665.64	6,170,127	1,089
11 Grand Trunk Western.....	2,155.23	1,575,262	731
12 Lehigh & New England.....	323.14	269,286	833
13 Lehigh Valley.....	2,937.57	3,167,413	1,078
14 Monongahela.....	285.64	226,080	791
15 New York Central.....	24,092.81	31,042,270	1,288
16 New York, Chgo. & St. Louis (Incl. W. & L. E.).....	3,976.31	3,817,636	960
17 New York, Ontario & Western.....	823.62	155,884	189
18 Pittsburgh & Lake Erie.....	1,048.25	1,186,424	1,132
19 Wabash.....	4,314.91	2,380,988	552
CENTRAL EASTERN REGION:			
20 Baltimore & Ohio.....	12,065.77	9,249,350	767
21 Bessemer & Lake Erie.....	575.80	577,885	1,004
22 Cent. R.R. of New Jersey (Incl. C.R.R. of Pa.).....	1,737.48	3,635,346	2,092
23 Chicago & Eastern Illinois.....	1,597.52	794,653	497
24 Chicago, Indianapolis & Louisville.....	817.40	403,745	494
25 Detroit, Toledo & Ironton.....	689.30	579,810	841
26 Elgin, Joliet & Eastern.....	1,080.37	1,297,786	1,201
27 Illinois Terminal.....	657.94	428,267	651
28 Long Island.....	911.63	3,968,366	4,353
29 Pennsylvania.....	25,109.59	28,919,126	1,152
30 Reading.....	3,326.18	3,043,000	915
31 Western Maryland.....	1,400.31	1,370,889	979
POCAHONTAS REGION:			
32 Chesapeake & Ohio (Incl. Pere M.).....	9,933.52	12,830,591	1,292
33 Norfolk & Western.....	4,736.55	9,372,667	1,979
34 Richmond, Fred'burg & Potomac.....	483.87	824,655	1,704
35 Virginian.....	1,096.51	2,264,275	2,065

* Represents total tax accruals other than United States Government taxes.

† A.A.R. Signal Section 1951 Proceedings, Vol. XLIX, pp. 14 and 365.

TABLE I—Continued

Railroad	Total miles of all track operated at close of year	State and local taxes*	
		Total	Per mile of track operated
SOUTHERN REGION:			
36 Alabama Great Southern.....	662.10	\$ 644,340	\$ 973
37 Atlantic Coast Line.....	7,826.27	4,788,668	612
38 Central of Georgia.....	2,694.79	1,463,477	543
39 Cincinnati, New Orleans & Tex. Pac.....	884.28	1,781,752	2,015
40 Clinchfield.....	480.27	1,165,543	2,427
41 Florida East Coast.....	1,225.58	1,028,692	839
42 Gulf, Mobile & Ohio.....	4,318.91	2,935,579	680
43 Illinois Central.....	11,200.52	12,170,219	1,087
44 Louisville & Nashville.....	7,951.36	8,040,555	1,011
45 Nashville, Chattanooga & St. Louis.....	1,714.10	1,285,535	750
46 Norfolk Southern.....	819.97	289,731	353
47 Seaboard Air Line.....	5,885.63	3,991,529	678
48 Southern.....	10,409.46	8,691,020	835
NORTHWESTERN REGION:			
49 Chicago & North Western.....	12,120.29	5,972,587	493
50 Chicago Great Western.....	2,167.70	1,049,768	484
51 Chicago, Milwaukee, St. Paul & Pacific.....	15,893.72	9,366,093	589
52 Chicago, St. Paul, Minneapolis & Omaha.....	2,418.41	1,163,518	481
53 Duluth, Missabe & Iron Range.....	1,199.04	2,837,423	2,366
54 Great Northern.....	12,199.09	12,219,328	1,002
55 Minneapolis & St. Louis.....	1,762.92	645,577	366
56 Soo Line (Incl. Wis. C.).....	5,465.16	2,404,819	440
57 Northern Pacific.....	10,636.57	8,786,761	826
58 Spokane, Portland & Seattle.....	1,265.51	1,456,486	1,151
CENTRAL WESTERN REGION:			
59 Atchison, Topeka & Santa Fe Sys.....	21,416.97	19,115,679	893
60 Chicago, Burlington & Quincy.....	13,667.10	10,093,568	739
61 Chicago, Rock Island & Pacific.....	11,279.61	6,379,534	566
62 Colorado & Southern.....	1,192.93	659,517	553
63 Denver & Rio Grande Western.....	3,822.88	3,288,013	860
64 Fort Worth & Denver.....	1,439.75	378,742	263
65 Northwestern Pacific.....	465.31	255,993	550
66 Southern Pacific.....	13,291.56	18,998,317	1,429
67 Union Pacific.....	15,826.27	17,509,157	1,106
68 Western Pacific.....	1,920.13	1,571,100	818
SOUTHWESTERN REGION:			
69 Gulf Coast Lines.....	1,684.95	631,252	375
70 International-Great Northern.....	1,465.68	439,239	300
71 Kansas City Southern.....	1,439.11	1,497,365	1,040
72 Louisiana & Arkansas.....	1,008.51	659,978	654
73 Missouri-Kansas-Texas.....	4,085.89	2,389,064	510
74 Missouri Pacific.....	10,483.84	5,920,218	565
75 Frisco Lines.....	6,783.98	4,107,270	605
76 St. Louis Southwestern.....	2,316.81	1,365,219	589
77 Texas & New Orleans.....	6,141.44	2,975,038	484
78 Texas & Pacific.....	2,712.30	1,393,412	514
Composite Average.....	371,444.91	340,340,290	916
AVERAGES BY REGIONS:			
New England.....	10,796.02	10,538,442	976
Great Lakes.....	50,182.48	56,434,462	1,125
Central Eastern.....	49,969.29	54,268,223	1,086
Poconantas.....	16,250.45	25,292,188	1,556
Southern.....	56,073.24	48,276,640	861
Northwestern.....	65,128.41	45,902,360	705
Central Western.....	84,322.51	78,249,920	928
Southwestern.....	38,722.51	21,378,055	552

* Represents total tax accruals other than United States Government taxes.

Action Recommended
Acceptance as information.

TRAIN HOUR VALUE

At the 1952 Annual Meeting* the Committee submitted a full report on this subject and presented Table II for the calendar year 1950. A revision of Table II for the calendar year 1951, which brings the information up-to-date with the latest available figures, is presented herein. As shown in Table II, total train hour cost (excluding train crew wages) for the year 1951 varied from a minimum of \$13.19 to a maximum of \$86.65, with a composite average of \$37.12 for the 78 railroads.

TABLE II

Specified Elements of Train Hour Cost
per Road Freight Train Hour—Year 1951
(Excluding road freight train crews' wages)

Railroad	Elements of train hour cost (per road freight train hour)			
	Fuel, supplies, enginehouse expense and locomotive repairs	Road freight locomotive depreciation	Payroll taxes on labor applicable to road freight locomotive repairs and enginehouse expense a	Total train hour cost (excluding train crew wages)
1	2	3	4	5=2+3+4
Item number in report	Items 2 to 8	Item 9	Item 11	Items 2 to 11
NEW ENGLAND REGION:				
1 Bangor & Aroostook.....	\$18.97	\$4.46	\$0.33	\$23.76
2 Boston & Maine.....	27.29	1.69	0.62	29.60
3 Central Vermont.....	29.23	0.46	0.51	30.20
4 Maine Central.....	18.99	2.22	0.43	21.64
5 New York, New Haven & Hartford.....	32.63	2.55	0.66	35.84
6 Rutland.....	24.58	0.95	0.47	26.00
GREAT LAKES REGION:				
7 Ann Arbor.....	16.42	3.85	0.24	20.51
8 Delaware & Hudson.....	58.65	3.28	1.33	63.26
9 Delaware, Lackawanna & Western.....	28.76	3.42	0.49	32.67
10 Erie (Incl. Chgo. & Erie).....	30.30	2.87	0.58	33.75
11 Grand Trunk Western.....	33.17	0.73	0.53	34.43
12 Lehigh & New England.....	13.02	7.16	0.16	20.34
13 Lehigh Valley.....	36.41	5.17	0.67	42.25
14 Monongahela.....	24.20	1.00	0.50	25.70
15 New York Central.....	35.44	2.12	0.67	38.23
16 New York, Chgo. & St. Louis (Incl. W. & L.E.).....	37.59	0.97	0.72	39.28
17 New York, Ontario & Western.....	18.30	3.98	0.43	22.71
18 Pittsburgh & Lake Erie.....	53.06	1.49	0.88	55.43
19 Wabash.....	30.60	3.73	0.46	34.79
CENTRAL EASTERN REGION:				
20 Baltimore & Ohio.....	36.41	1.39	0.81	38.61
21 Bessemer & Lake Erie.....	80.75	4.00	1.90	86.65
22 Cent. R.R. of New Jersey (Incl. C.R.R. of Pa.).....	39.93	2.84	0.84	43.61
23 Chicago & Eastern Illinois.....	24.02	3.95	0.43	28.40
24 Chicago, Indianapolis & Louisville.....	27.51	3.57	0.54	31.62

a Payroll taxes calculated at rate of 5.75 per cent. Reduction from actual rate of 6.50 per cent account compensation in excess of \$300 per month.

*A.A.R. Signal Section 1951 Proceedings, Vol. XLIX, pp. 24 and 366.

TABLE II—Continued

Railroad	Elements of train hour cost (per road freight train hour)			
	Fuel, supplies, enginehouse expense and locomotive repairs	Road freight locomotive depreciation	Payroll taxes on labor applicable to road freight locomotive repairs and enginehouse expense a	Total train hour cost (excluding train crew wages)
1	2	3	4	5=2+3+4
Item number in report	Items 2 to 8	Item 9	Item 11	Items 2 to 11
CENTRAL EASTERN REGION—Con.:				
25 Detroit, Toledo & Ironton.....	\$27.83	\$1.50	\$0.46	\$29.79
26 Elgin, Joliet & Eastern.....	13.28	1.86	0.27	15.41
27 Illinois Terminal Co.....	11.95	1.02	0.22	13.19
28 Long Island.....	17.18	1.11	0.34	18.63
29 Pennsylvania.....	38.57	2.77	0.78	42.12
30 Reading.....	31.23	2.38	0.61	34.22
31 Western Maryland.....	47.93	3.12	1.09	52.14
POCAHONTAS REGION:				
32 Chesapeake & Ohio (Incl. Pere M.).....	39.86	2.69	0.79	43.34
33 Norfolk & Western.....	48.62	1.69	0.92	51.23
34 Richmond, Fred'burg & Potomac.....	35.31	3.87	0.49	39.67
35 Virginian.....	34.90	2.96	0.77	38.63
SOUTHERN REGION:				
36 Alabama Great Southern.....	39.33	7.09	0.88	47.30
37 Atlantic Coast Line.....	23.19	2.42	0.43	26.04
38 Central of Georgia.....	24.58	1.83	0.47	26.88
39 Cincinnati, New Orleans & Tex. Pac.....	41.07	7.56	0.94	49.57
40 Clinchfield.....	37.90	3.76	0.85	42.51
41 Florida East Coast.....	27.14	3.13	0.40	30.67
42 Gulf, Mobile & Ohio.....	32.99	5.57	0.70	39.26
43 Illinois Central.....	29.82	0.84	0.57	31.23
44 Louisville & Nashville.....	30.24	1.48	0.60	32.32
45 Nashville, Chattanooga & St. Louis.....	18.78	3.73	0.28	22.79
46 Norfolk Southern.....	29.29	2.19	0.69	32.17
47 Seaboard Air Line.....	27.67	3.69	0.53	31.89
48 Southern.....	28.99	3.90	0.64	33.53
NORTHWESTERN REGION:				
49 Chicago & North Western.....	25.66	2.87	0.42	28.95
50 Chicago Great Western.....	23.74	6.07	0.32	30.13
51 Chicago, Milwaukee, St. Paul & Pac.....	30.60	2.14	0.52	33.26
52 Chicago, St. Paul, Minneapolis & Omaha.....	23.57	1.19	0.30	25.06
53 Duluth, Missabe & Iron Range.....	62.05	0.56	1.21	63.82
54 Great Northern.....	31.29	1.83	0.58	33.70
55 Minneapolis & St. Louis.....	18.70	2.65	0.39	21.74
56 Soo Line (Incl. Wis. C.).....	28.42	2.32	0.51	31.25
57 Northern Pacific.....	36.25	1.96	0.72	38.93
58 Spokane, Portland & Seattle.....	22.12	2.80	0.40	25.32
CENTRAL WESTERN REGION:				
59 Atchison, Topeka & Santa Fe Sys.....	34.95	2.23	0.64	37.82
60 Chicago, Burlington & Quincy.....	26.93	2.19	0.39	29.51
61 Chicago, Rock Island & Pacific.....	25.76	1.20	0.41	27.37
62 Colorado & Southern.....	28.57	2.07	0.37	31.01
63 Denver & Rio Grande Western.....	43.49	3.55	0.87	47.91

a Payroll taxes calculated at rate of 5.75 per cent. Reduction from actual rate of 6.50 per cent account compensation in excess of \$300 per month.

TABLE II—Continued

Railroad	Elements of train hour cost (per road freight train hour)			
	Fuel, supplies, enginehouse expense and locomotive repairs	Road freight locomotive depreciation	Payroll taxes on labor applicable to road freight locomotive repairs and enginehouse expense a	Total train hour cost (excluding train crew wages)
1	2	3	4	5 = 2 + 3 + 4
Item number in report	Items 2 to 8	Item 9	Item 11	Items 2 to 11
CENTRAL WESTERN REGION—Con.:				
64 Fort Worth & Denver.....	\$27.42	\$1.62	\$0.42	\$29.46
65 Northwestern Pacific.....	13.02	0.06	0.22	13.30
66 Southern Pacific.....	41.75	3.35	0.92	46.02
67 Union Pacific.....	51.82	2.76	0.90	55.48
68 Western Pacific.....	34.32	4.44	0.64	39.40
SOUTHWESTERN REGION:				
69 Gulf Coast Lines.....	26.06	3.54	0.57	30.17
70 International-Great Northern.....	28.42	3.02	0.58	32.02
71 Kansas City Southern.....	33.39	3.90	0.57	37.86
72 Louisiana & Arkansas.....	22.67	2.63	0.37	25.67
73 Missouri-Kansas-Texas.....	24.73	2.26	0.42	27.41
74 Missouri Pacific.....	31.57	2.74	0.59	34.90
75 Frisco Lines.....	26.26	3.48	0.44	30.18
76 St. Louis Southwestern.....	28.45	1.71	0.50	30.66
77 Texas & New Orleans.....	34.48	0.57	0.68	35.73
78 Texas & Pacific.....	28.80	4.49	0.41	33.70
Composite Average.....	34.03	2.44	0.65	37.12
AVERAGES BY REGIONS:				
New England.....	27.64	2.12	0.58	30.34
Great Lakes.....	35.04	2.37	0.66	38.07
Central Eastern.....	36.27	2.31	0.76	39.34
Pocahontas.....	42.05	2.43	0.83	45.31
Southern.....	28.77	2.65	0.57	31.99
Northwestern.....	30.33	2.24	0.54	33.11
Central Western.....	37.96	2.54	0.70	41.20
Southwestern.....	29.67	2.57	0.54	32.78

a Payroll taxes calculated at rate of 5.75 per cent. Reduction from actual rate of 6.50 per cent account compensation in excess of \$300 per month.

Action Recommended

Acceptance as information.

TRACK AND ROADWAY MAINTENANCE EXPENSES— PER EQUATED TRACK MILE

At the 1952 Annual Meeting* the Committee submitted a report on this subject and presented Table I for the calendar year 1950. A revision of Table I for the calendar year 1951, which brings the information up-to-date with the latest available figures, is presented herein. As shown in Table I, track and roadway maintenance expenses per equated track mile for the year 1951 varied from a minimum of \$1,376 to a maximum of \$9,971, with a composite average of \$3,181 for the 78 railroads.

Table I also shows gross ton-miles per mile of road (traffic density) which varied from a minimum of 2,280 to a maximum of 24,946, with a composite average of 8,818 gross ton-miles for the 78 railroads.

TABLE I

Track and Roadway Maintenance Expenses per Equated
Track Mile (Running Tracks) and Traffic Density
Calendar Year 1951

Railroad	Equated track miles (running tracks) a	Track and roadway maintenance expenses		Gross ton-miles per mile of road (traffic density) d (000)
		Total b	Per equated track mile c	
NEW ENGLAND REGION:				
1 Bangor & Aroostook.....	656.34	\$1,630,990	\$2,485	2,280
2 Boston & Maine.....	2,208.45	7,463,494	3,380	6,701
3 Central Vermont.....	394.72	1,189,284	3,013	4,652
4 Maine Central.....	1,068.57	3,274,351	3,064	3,469
5 New York, New Haven & Hartford.....	2,431.58	9,971,925	4,101	9,449
6 Rutland.....	427.28	608,481	1,424	2,369
GREAT LAKES REGION:				
7 Ann Arbor.....	321.24	729,548	2,271	5,187
8 Delaware & Hudson.....	998.13	4,319,746	4,328	14,152
9 Delaware, Lackawanna & Western.....	1,525.43	5,035,448	3,301	13,867
10 Erie (Incl. Chgo. & Erie).....	3,316.61	12,671,474	3,821	13,755
11 Grand Trunk Western.....	1,272.14	4,901,886	3,853	9,682
12 Lehigh & New England.....	179.23	592,698	3,307	4,405
13 Lehigh Valley.....	1,742.23	5,262,437	3,021	9,844
14 Monongahela.....	206.99	556,570	2,689	7,515
15 New York Central.....	14,974.97	52,494,297	3,505	13,004
16 New York, Chgo. & St. Louis (Incl. W.&L.E.).....	2,607.03	10,147,035	3,892	13,479
17 New York, Ontario & Western.....	523.13	772,461	1,477	2,390
18 Pittsburgh & Lake Erie.....	374.53	3,135,898	8,373	20,353
19 Wabash.....	2,546.16	8,065,609	3,168	8,826

a Based on a weight of 100 for first main track, 80 for additional main track, passing tracks, crossovers, and turnouts operated; mileage operated under trackage rights is excluded.

b Includes charges for maintenance of running tracks to operating expense accounts 202, 208, 212, 214, 216, 218, 220, and total charges to accounts 269, 270, 271, 272, and 274.

c Represents equivalent expense for 1 mile of first main track. Expense per mile of additional main track, passing tracks, crossovers, and turnouts may be computed as 80 per cent of this amount.

d Represents gross ton-miles (including locomotive and tender) freight and passenger service per mile of first main track.

TABLE I—Continued

Railroad	Equated track miles (running tracks) a	Track and roadway maintenance expenses		Gross ton-miles per mile of road (traffic density) d (000)
		Total b	Per equated track mile c	
CENTRAL EASTERN REGION:				
20 Baltimore & Ohio.....	7,896.96	\$35,115,802	\$4,447	13,152
21 Bessemer & Lake Erie.....	322.05	1,389,361	4,314	20,348
22 Cent. R.R. of New Jersey (Incl. C.R.R. of Pa.)	838.26	3,973,464	4,740	11,006
23 Chicago & Eastern Illinois.....	949.49	1,943,910	2,047	6,494
24 Chicago, Indianapolis & Louisville.....	567.74	2,033,233	3,581	6,049
25 Detroit, Toledo & Ironton.....	477.21	1,425,467	2,987	4,669
26 Elgin, Joliet & Eastern.....	277.39	1,661,686	5,990	16,374
27 Illinois Terminal.....	513.00	1,002,496	1,954	2,394
28 Long Island.....	579.26	2,687,500	4,640	8,714
29 Pennsylvania.....	14,855.37	63,708,376	4,289	16,767
30 Reading.....	2,143.83	8,166,485	3,809	12,434
31 Western Maryland.....	863.89	3,515,777	4,070	9,121
POCAHONTAS REGION:				
32 Chesapeake & Ohio (Incl. Pere M.).....	5,744.77	26,334,355	4,584	15,514
33 Norfolk & Western.....	2,974.81	15,379,851	5,170	21,406
34 Richmond, Fred'burg & Potomac.....	237.54	2,368,557	9,971	38,136
35 Virginian.....	717.08	2,884,155	4,022	15,446
SOUTHERN REGION:				
36 Alabama Great Southern.....	377.74	1,730,087	4,580	12,097
37 Atlantic Coast Line.....	6,293.99	17,819,738	2,831	6,178
38 Central of Georgia.....	1,907.55	4,432,664	2,324	4,838
39 Cincinnati, New Orleans & Tex. Pac.....	585.02	3,460,734	5,916	24,946
40 Clinchfield.....	328.69	2,252,381	6,853	14,249
41 Florida East Coast.....	945.87	2,252,848	2,382	9,348
42 Gulf, Mobile & Ohio.....	2,992.96	9,156,824	3,059	5,676
43 Illinois Central.....	7,909.72	27,712,299	3,504	9,170
44 Louisville & Nashville.....	5,596.60	17,770,038	3,175	8,874
45 Nashville, Chattanooga & St. Louis.....	1,188.77	4,781,967	4,023	6,655
46 Norfolk Southern.....	699.05	1,598,020	2,286	2,743
47 Seaboard Air Line.....	4,652.70	16,177,126	3,477	7,197
48 Southern.....	7,022.71	21,165,797	3,014	7,079
NORTHWESTERN REGION:				
49 Chicago & North Western.....	8,992.26	18,720,120	2,082	5,039
50 Chicago Great Western.....	1,483.68	3,356,092	2,262	5,329
51 Chicago, Milwaukee, St. Paul & Pac.....	11,426.36	18,199,327	1,593	4,907
52 Chicago, St. Paul, Minneapolis & Omaha.....	1,811.16	3,494,492	1,929	4,157
53 Duluth, Missabe & Iron Range.....	749.12	3,305,256	4,412	14,889
54 Great Northern.....	8,852.49	26,276,092	2,968	6,095
55 Minneapolis & St. Louis.....	1,363.95	2,537,570	1,860	2,647
56 Soo Line (Incl. Wis. C.).....	4,352.66	8,644,663	1,986	3,916
57 Northern Pacific.....	7,704.58	15,424,366	2,002	5,363
58 Spokane, Portland & Seattle.....	964.19	2,989,767	3,101	6,197
CENTRAL WESTERN REGION:				
59 Atchison, Topeka & Santa Fe Sys.....	15,820.16	52,683,929	3,330	9,829
60 Chicago, Burlington & Quincy.....	9,760.03	24,286,316	2,488	6,478
61 Chicago, Rock Island & Pacific.....	8,374.11	16,688,331	1,993	5,403
62 Colorado & Southern.....	650.99	925,436	1,422	4,691
63 Denver & Rio Grande Western.....	2,596.90	5,796,560	2,232	6,784

a Based on a weight of 100 for first main track, 80 for additional main track, passing tracks, crossovers, and turnouts operated; mileage operated under trackage rights is excluded.

b Includes charges for maintenance of running tracks to operating expense accounts 202, 203, 212, 214, 216, 218, 220, and total charges to accounts 269, 270, 271, 272, and 274.

c Represents equivalent expense for 1 mile of first main track. Expense per mile of additional main track, passing tracks, crossovers, and turnouts may be computed as 80 per cent of this amount.

d Represents gross ton-miles (including locomotive and tender) freight and passenger service per mile of first main track.

TABLE I—Continued

Railroad	Equated track miles (running tracks) a	Track and roadway maintenance expenses		Gross ton-miles per mile of road (traffic density) d (000)
		Total b	Per equated track mile c	
CENTRAL WESTERN REGION—Con.:				
64 Fort Worth & Denver.....	831.31	\$1,143,688	\$1,376	5,632
65 Northwestern Pacific.....	369.21	1,927,037	5,219	5,142
66 Southern Pacific.....	9,486.40	33,341,266	3,515	13,018
67 Union Pacific.....	11,690.38	40,832,933	3,493	12,095
68 Western Pacific.....	1,265.92	5,683,818	4,490	9,241
SOUTHWESTERN REGION:				
69 Gulf Coast Lines.....	1,246.60	4,426,590	3,551	4,780
70 International-Great Northern.....	1,130.22	4,966,420	4,394	6,889
71 Kansas City Southern.....	990.44	3,055,212	3,085	10,516
72 Louisiana & Arkansas.....	706.74	3,116,722	4,410	5,373
73 Missouri-Kansas-Texas.....	3,344.81	6,872,695	2,055	4,888
74 Missouri Pacific.....	7,535.76	27,255,599	3,617	7,365
75 Frisco Lines.....	5,238.48	13,657,533	2,607	5,514
76 St. Louis Southwestern.....	1,542.26	5,904,049	3,828	8,444
77 Texas & New Orleans.....	4,614.34	13,501,934	2,926	6,929
78 Texas & Pacific.....	2,075.62	5,982,092	2,882	8,795
Composite Average.....	255,205.91	811,720,535	3,181	8,818
AVERAGES BY REGIONS:				
New England.....	7,186.94	24,138,525	3,359	6,109
Great Lakes.....	30,587.82	108,685,107	3,553	12,072
Central Eastern.....	30,284.45	126,623,557	4,181	13,740
Peachontas.....	9,674.20	46,966,918	4,855	17,410
Southern.....	40,501.37	130,310,523	3,217	7,575
Northwestern.....	47,700.45	102,947,745	2,158	5,203
Central Western.....	60,845.41	183,309,314	3,013	9,212
Southwestern.....	28,425.27	88,738,846	3,122	6,733

a Based on a weight of 100 for first main track, 80 for additional main track, passing tracks, crossovers, and turnouts operated; mileage operated under trackage rights is excluded.

b Includes charges for maintenance of running tracks to operating expense accounts 202, 208, 212, 214, 216, 218, 220, and total charges to accounts 269, 270, 271, 272, and 274.

c Represents equivalent expense for 1 mile of first main track. Expense per mile of additional main track, passing tracks, crossovers, and turnouts may be computed as 80 per cent of this amount.

d Represents gross ton-miles (including locomotive and tender) freight and passenger service per mile of first main track.

Action Recommended

Acceptance as information.

ECONOMICS OF MINIMIZING TRACK CIRCUIT RAIL BOND FAILURES

A tabulation compiled by the I.C.C., based on reports of signal failures submitted by the railroads for the period July 1, 1948 to June 30, 1949, showed a total of 5,270 signal failures due to broken or defective rail bonds. These bond failures were nearly 19 per cent of the number of failures chargeable to automatic and interlocking signals, which totaled 28,082 during the same 12 months.

Because of the large percentage of bond failures, Committee I endeavored to find out more about the costs involved to determine possible economics of the problem; the economics not only to include the cost of replacing bonds but, of more importance, the cost of resultant train stops and delays.

As a consequence, a questionnaire was circulated among the membership of Committee I, requesting detailed information as to cause of the failures, cost of replacement, and cost of train stops and delays for a representative period. Reports received from nine railroads were quite complete. Reports from other railroads, while not as comprehensive, did so far as they covered, coincide with the other nine, so together they reflected conditions which it is believed exist generally on all railroads.

The information requested was primarily for failures occurring during summer and winter, for purpose of comparison of the two seasons. However, most of the railroads reported for a period of several months so when tabulated all the months were included for both years 1950 and 1951. No outstanding difference between months or seasons was noted in the reports.

A brief summary of information received is as follows:

1. Twenty-four of the failures reported occurred during regular work hours and 158 occurred after regular hours or on off days when overtime rates were required.

The variation in labor costs for regular time rate was from \$1.81 to \$11.55 per failure, with one outstanding case of \$42.88. The variation in overtime cases was from \$6.90 to \$18.39 per failure, with two cases of \$29.29 and \$29.87, respectively. The latter three were due to a large number of bonds cut off by dragging equipment.

The signal department total labor cost for 182 failures was \$1,729, averaging \$9.50 per failure.

2. The cost of material for each signal failure varied according to the number and type of bonds replaced.

The total material cost for 182 failures was \$272, or about \$0.90 per failure.

3. A total of 182 failures was reported, but in only 142 failures was the type of bond identified; 117 were rail head plug type; 9 rail head weld type, and 16 long web type. This distribution of failures by type of bond should not be taken as indicative of the relative merits of particular types of bonds since no relative comparison with total number in service is afforded.

4. General causes of bond failures were:

- Dragging equipment
- Bonds improperly applied
- Bonds broken maliciously
- Bad condition of rail joint
- Vibration in rail joint and in bond
- Weather conditions
- Bond burned off by welders
- Defective bonds
- Undetermined

There were more failures due to dragging equipment than any other single cause.

5. All but two of the railroads reported cost of train stops in accordance with formula shown in A.A.R. Signal Section 1946 Proceedings, Vol. XLIV, pp. 7-A and 326-A and 1950 Proceedings, Vol. XLVIII, pp. 7 and 388, and on nine railroads it varied from \$1.25 to \$5.42 per stop.

One railroad reported \$1.25 per stop for passenger trains and \$2 per stop for freight trains.

Another railroad reported its own formula which is rather complex as it is based on calculated values for passenger and freight trains for the stop plus the cost to resume speed after stopping and divided between regular time and overtime. Approximately, this equals for passenger trains \$7 at regular time rate and \$7.72 at overtime rate, and for freight trains \$5.77 at regular rate and \$6.98 at overtime rate.

A total of 236 trains was reported making one stop each, with a total cost for all stops of \$922.

6. Eight of the nine railroads used the cost of train delay time in accordance with train hour cost as shown in A.A.R. Signal Section 1949 Proceedings, Vol. XLVII, pp. 44 and 320 and 1950 Proceedings, Vol. XLVIII, pp. 38 and 390. These costs per hour are different for each year even for the same railroad and also vary depending upon the length of the delay time.

One railroad used its own special formula based on cost for passenger trains amounting to \$2.58 per hour at straight time and \$11.88 on overtime, and for freight trains \$5.76 per hour at straight time and \$16.44 per hour on overtime.

The average delay time for passenger trains varied from 5 to 24 minutes per train and for freight trains from 9 to 55 minutes per train. The total delay time was as follows:

125 passenger trains	—a total of 25 hours 12 minutes
84 freight trains	—a total of 15 hours 4 minutes
27 unidentified trains	—a total of 5 hours 30 minutes
236 trains	—a total of 45 hours 46 minutes

The cost of train detention per failure varied from \$1.23 to \$21.35 for freight trains and from \$0.34 to \$39.72 for passenger trains.

The total cost for the total detention time for 45 hours and 46 minutes was \$1,394 or just less than \$6 per train.

A summary of all the costs involved for the 182 failures and the 236 trains is as follows:

Signal department charges for labor.....	\$1,729
Signal department charges for material.....	272
236 train stops	922
Delay time of 45 hours and 46 minutes.....	1,394
Total cost.....	\$4,317

For the 182 failures, the average cost per failure is therefore \$23.72.

As has been shown, a wide range of variation is indicated which makes it impractical to arrive at a specific cost figure per bond failure. The Committee is convinced from these reports that the cost of train stops and train delay time is a very definite part of the cost chargeable to bond failures, and also believes that the average cost per bond failure, as developed in this report, is a representative cost. Furthermore, this report is enlightening because when including cost for train stops and delays the cost per bond failure is at least doubled over the generally accepted cost based only on signal department charges.

For these reasons, it is the conclusion of the Committee that substantial savings, over and above signal department cost of replacement, can be achieved by minimizing rail bond failures.

Action Recommended

Acceptance as information.

OPERATING ADVANTAGES OF CENTRALIZED TRAFFIC
CONTROL REPLACING MULTIPLE REMOTE CONTROL
TRAIN OPERATION BY SIGNAL INDICATION,
GRAFTON TO PARKERSBURG, W. VA., ON
THE BALTIMORE & OHIO R.R.

On January 1, 1952, the Baltimore & Ohio R.R.* placed in service a complete centralized traffic control system in lieu of local remote control operated from 14 points. The installation embraces the territory between Grafton and Parkersburg, W. Va., a 103-mile subdivision on the route from New York-Baltimore-Washington to Cincinnati-St. Louis. There are 86.9 miles of single track, 16.1 miles of two main track, 4 single operating sidings, 8 lap operating sidings, and 2 sidings at the end of two main track.

Ninety miles of the line is in rough terrain in the foothills of the Allegheny Mountains. It passes over 8 major crests, with ascending grades averaging 1.0 per cent (and up to 1.25 per cent) for 2 miles or more in each direction toward each crest. There is considerable curvature ranging up to about 6 degrees, a few up to 8 degrees, and one of 9 degrees 30 minutes. There are 22 tunnels, one of which is 2,800 feet long.

The maximum permissible speed is 45 miles per hour for passenger trains and 35 miles per hour for freight trains.

Eight passenger trains and 8 scheduled freight trains are operated daily. A local freight train runs eastward one day and westward the next. An extra express and mail train is operated nearly every day during rush seasons, and extra freight trains are run when required. Thus, about 18 to 20 trains are operated daily over the subdivision. In addition, 10 to 12 mine run trains operate west out of and return to Grafton. Since this territory is the mid-point (on time basis) between New York and St. Louis, the four most important passenger trains meet on this section during the night. Likewise, most of the fast freight trains are operated at night. Therefore, about 75 per cent of the through trains are bunched on this subdivision between 8:00 p.m. and 6:00 a.m.

Passenger trains and quick-dispatch freight trains are powered by Diesel locomotives, while all other trains are powered by steam locomotives.

Train operation by signal indication with the switches and signals controlled by desk type interlocking machines at 14 intermediate block offices under telephone direction of the dispatcher was instituted on this territory in 1929.

In the 1951 project, a centralized traffic control machine in the dispatcher's office brought the switches and signals under direct control of the dispatcher, part by direct code and part by carrier link.

The new system of centralized traffic control from the dispatcher's office has:

- (a) Made possible a more efficient utilization of existing track facilities.
- (b) Brought about smoother train operation and thus improved on-time train performance.
- (c) Eliminated time required for the dispatcher and the intermediate operator to "get-together" on a train movement (the dispatcher now has a

* *Railway Signaling and Communications*, January 1952, p. 35.

first-hand complete picture of the location and progress of each train) thus saving a few minutes here and there which amounts to 20 or 25 minutes for a through freight train on the 103-mile run.

(d) Made possible the efficient handling of extra trains without disrupting other operations.

(e) Made a decided reduction in operating expenses, sufficient to pay for the capital cost of the signaling improvement in 4 years.

Economic Statement

1. Cost of Installation:		
(a) Capital Investment.....	\$721,418	
(b) Operating Expenses.....	210,207	
(c) Total.....		\$931,625
2. Gross Saving per Annum.....		
		\$255,146
3. Increased Annual Operating Expenses.....		
		8,270
4. Net Reduction in Annual Operating Expenses.....		
		\$246,876
5. Deduction for Interest Charges @ 5% (of 1-a).....		
		36,071
6. Net Saving per Annum.....		
		\$210,805
7. Annual Return over 5% Interest:		
(a) On Capital Investment ($6 \div 1-a$).....		29.2%
(b) On Total Cost ($6 \div 1-c$).....		22.6%

Action Recommended

Acceptance as information.

ECONOMICS OF SIGNALING FOR EXPEDITING TRAFFIC
THROUGH YARDSUNION PACIFIC, DENVER & RIO GRANDE WESTERN
AND WESTERN PACIFIC RAILROADS

During May 1951, the Union Pacific, Denver & Rio Grande Western and Western Pacific Railroads placed in service a unit wire electric interlocking, NX type, at Salt Lake City, Utah.

The original layout was, generally speaking, single track for all movements including the interchange movement, and required a slow, 12-mile per hour movement for approximately $1\frac{1}{2}$ miles for all Rio Grande trains on account of occupying a city street. The new layout eliminated the track in the city street and provided two tracks for interchange movement at reduced gradient.

Formerly, trains of all roads were required to make certain stops in each direction and trainmen were required to position certain switches for through movement and make the second stop to restore the switches in their normal position.

The daily through traffic consists of (average):

Passenger trains	Freight trains	Total trains
3 W.P.	7 W.P.	10 W.P.
2 R.G.	9 R.G.	11 R.G.
0 U.P.	26 U.P.	<u>26 U.P.</u>
		47

In addition to the 47 daily through or regular train movements, there is a daily average of 8 heavy tonnage interchange movements, 4 fast stockyard movements and 65 miscellaneous switching movements. Some of the switching movements necessitated the hand-operation of gates by trainmen.

The project eliminated approximately two stops per through train movement, which totals 34,310 stops annually, with a saving in time of 15 to 30 minutes per through train, and 47,450 switching stops eliminated. Estimated annual saving due to elimination of these stops is \$96,725.

Economic Statement

1. Cost of Installation:

(a) Capital Investment (Acct. 27 only).....	\$286,807
(b) Operating Expenses.....	—
(c) Total.....	<u>\$286,807</u>

2. Gross Saving per Annum.....	\$ 96,725
3. Increased Annual Operating Expenses.....	25,500
4. Net Reduction in Annual Operating Expenses.....	\$ 71,225
5. Deduction for Interest Charges @ 4% (of 1-a).....	11,472
6. Net Saving per Annum.....	<u>\$ 59,753</u>
7. Annual Return over 4% Interest:	
(a) On Capital Investment ($6 \div 1-a$).....	20.8%

Summary

The track changes also expedited through train and switching movements (the cost of which has not been included). The time gained incidental to track

relocation has not been included. The estimated net saving of \$59,753 due to signaling shows a return of 20.8 per cent on capital investment.

In addition, the safety of train operation has been increased.

UNION PACIFIC R.R.

The Union Pacific R.R. reports an installation of a remote-controlled layout at one end of a fairly busy terminal. At this terminal the entire yard is located on one side of the main tracks, which, in this case, is two track.

Prior to the installation of the remotely controlled system, all westward freight trains stopped at the entering switch and called the yard office for information as to which track to enter, hand-operated the necessary switches to cross the eastward track and to enter the yard.

Very often these movements were delayed for a considerable time in addition to time required to obtain the information and line switches, by eastward passenger train movements being due or overdue.

Eastward freight trains departed from the yard through a spring switch, all their movements being from one departure lead.

The work at this terminal required considerable switching service which interfered with many of the eastward departure movements.

The traffic averages 40 to 50 freight trains per day, fairly equally divided as to direction and 20 passenger trains. The freight train delays varied from 10 minutes to 1 hour in getting in or departing from the yard.

Yard track changes were made to provide two departure tracks, the departure track switches being arranged for power operation. Crossover switches and yard entering switches were also changed to power operation. Full complement of signals was provided for the layout and the entire layout controlled from the dispatcher's office 2 miles distant. A yard track indicator (20 track) was also provided at the entering switch.

Delays to freight trains are reduced to the minimum as the dispatcher has complete control of all trains entering and leaving the yard.

Economic Statement

1. Cost of Installation:		
(a) Capital Investment.....	\$86,870	
(b) Operating Expenses.....	3,284	
(c) Total.....		\$90,154
2. Gross Saving per Annum.....		\$24,441
3. Increased Annual Operating Expenses.....		1,200
4. Net Reduction in Annual Operating Expenses.....		\$23,241
5. Deduction for Interest Charges @ 5% (of 1-a).....		4,343
6. Net Saving per Annum.....		\$18,898
7. Annual Return over 5% Interest:		
(a) On Capital Investment ($6 \div 1-a$).....		21.8%
(b) On Total Cost ($6 \div 1-c$).....		20.9%

Action Recommended

Acceptance as information.

COMMITTEE II—INTERLOCKING

Personnel

H. A. Hudson, Chairman

R. W. Troth, Vice-Chairman

R. B. Amsden

C. F. Brooks

W. A. Ford

D. W. Fuller

C. F. Grundy

E. K. Horns

C. T. Marak

C. A. Martenson

C. B. Mason

H. A. Maynard

H. L. Moseley

K. L. Muse

O. S. Penman

V. P. Shepardson

C. M. Wallace

V. J. Ward

J. F. Yerger

F. J. Ackerman*

J. P. Hopton*

Signal Section, A.A.R.:

The following outline of work has been assigned:

1. Revision of Manual.
2. Indexing signal literature.
3. Collaborate with A.R.E.A. Committee 5 on switch, frog and crossing layout plans, in order to make layouts as universal as possible for the application of signals and interlocking, including location of insulated rail joints in turnouts, crossovers and crossings.
4. Investigate and report on various types of detectors used in connection with signal systems.
5. Investigate and report on recommended methods of prevention, detection and extinguishing of fires in control stations of interlocking, classification yard and traffic control systems, collaborating with Fire Protection and Insurance Section, A.A.R.

The Committee submits for consideration, reports on the following subjects**:

1. Revision of Specification 130-47, Manual Part 48.
Revision of Specification 208-44, Manual Part 210.
3. Plans for switches, frogs, crossings, spring and slip switches.
5. Recommended methods of prevention, detection and extinguishment of fires in interlocking, classification yard and traffic control systems.
Progress report on specifications for electrical heaters for track switches.

* Consulting Member.

** Suggestions or criticisms should be submitted in writing to the Chairman of the Committee on or before August 28, 1953.

Disposition of 1952 Letter Ballot Subjects

The following subjects presented by Committee II at the 1952 Annual Meeting were submitted to letter ballot and officially approved:

Specification 152-52—Electro-Pneumatic Switch Operating Mechanism—Now in Manual Part 30.

Specification 99-52—Electric Locks for Interlocking Machines—Now in Manual Part 96.

Specification 101-52—Electric Motor Switch Operating Mechanism—Now in Manual Part 104.

Specification 134-52—Electro-Mechanical Interlocking Machine—Now in Manual Part 193.

(Revision of A.A.R. Signal Section Specification 130-47)
A.A.R. SIGNAL SECTION SPECIFICATION 130-53.

CIRCUIT CONTROLLER FOR MOVABLE BRIDGES

1. *Purpose.*

(a) This specification is for the purpose of providing for circuit controllers for the opening and closing of electrical circuits, of first and second voltage ranges*, between the shore structures and bridge ends of movable bridges. It sets forth specific detail requirements representing modern signal practice recommended for new installations and for replacement on existing installations when general renewal or replacement becomes desirable.

2. *Specifications and drawings.*

(a) Specifications and drawings referred to in the body of this specification form an essential part hereof.

(b) Manufacturer shall furnish with his tender, drawings forming an essential part thereof.

3. *Tender.*

(a) The tender shall be for a product meeting the requirements of this specification in its entirety.

4. *Purchaser's order requirements.*

(a) The following additional requirements will be shown on Purchaser's order:

1. Details of application.
2. Fittings for movable member.
3. Adapter fitting for wire entrance.
4. Contact circuit load characteristics.
5. Special features.
6. Inspection and tests as required.
7. Alternate requisites as required.

5. *Alternates.*

(a) The provisions contained in the alternate requisites section of this specification form a part hereof only when substituted by Purchaser's order for the provisions contained in this specification.

6. *Material and workmanship.*

(a) Material and workmanship shall be first-class in every respect.

* See Manual Part 170.

7. Design.

(a) Controller shall consist of two members, one stationary and one movable. The movable member shall permit a minimum stroke of 10 in.

(b) Controller shall be designed for application as specified by Purchaser.

(c) Each member shall be enclosed in a substantial metallic case, designed to provide weatherproof protection for the contact members when controller is in the closed position. The covers when open shall permit access to all parts.

(d) Bolts, nuts and threads shall be in accordance with Specifications for Bolts, Nuts and Threads, Manual Part 17.

(e) Bolts and screws shall be provided with lock washers or equivalent.

(f) Cap screw heads shall be hexagonal.

(g) Each member shall be provided with not less than three holes for $\frac{3}{4}$ in. bolts for securing in place.

(h) The movable member of controller shall be designed for connection with 1 in. pipe fittings as specified by Purchaser.

(i) Controller contacts shall function properly with a maximum longitudinal variation of 4 in. between the two anchors of the controller. *R-7-i.

(j) Contacts shall be self-centering and controller shall function properly with a maximum variation of $\frac{1}{2}$ in. between centers.

(k) Like parts of same Manufacturer's apparatus shall be interchangeable.

(l) Controller shall be so constructed that all parts may be readily removed.

(m) Provision shall be made for adequate and convenient lubrication.

(n) Ducts or channels of adequate capacity shall be provided for wiring, as required.

(o) Each member shall be provided with wire entrance conveniently located for access to binding posts, equipped with adapter fitting of size and type specified by Purchaser and arranged to protect wires from mechanical injury.

8. Wiring.

(a) Internal wiring shall be neatly arranged and placed in ducts or channels.

(b) Wire for internal wiring shall be in accordance with Specification 111, Manual Part 186, and consist of strands of copper not larger than No. 27 A.W.G. wire. The aggregate cross-section of the strands shall be not less than No. 12 A.W.G. wire. Wire eyelet shall be provided at each end, or other suitable terminal provided.

* Alternate requisites section.

9. *Binding posts.*

(a) Binding posts, nuts and washers, not used for fastening contact spring assemblies, shall conform to Drawing 1070 or 1078. Assembly shall conform to Drawing 1070, assembly 107010 or 107020.

(b) Binding posts, nuts and washers, when used for fastening contact spring assemblies, shall be $\frac{3}{8}$ -16. Material shall be in accordance with Specifications for Various Types of Non-Ferrous Metals and Alloys, Manual Part 220.

(c) Binding posts shall be mounted so they cannot be turned in the base or frame to which applied. They shall be properly insulated from each other and other metallic parts.

(d) Binding posts shall be spaced not less than 1 in. centers.

(e) Binding posts for external wires shall, as far as practicable, be located adjacent to wire inlet.

10. *Contacts.*

(a) Contact members shall be made of corrosion-resisting metal of sufficient mechanical strength.

(b) Movement of the contact members shall be such as will provide a wiping contact.

(c) Contacts shall be designed for circuit load characteristics as specified by Purchaser.

11. *Finish.*

(a) Metal parts shall be protected against corrosion except where such protection will interfere with the proper functioning of that part.

(b) Material used for protection against corrosion shall neither melt nor flake under atmospheric conditions between temperatures of 40 deg. F. below zero and 185 deg. F. above zero.

12. *Painting.*

(a) Painting shall be in accordance with Specification 120, Manual Part 110.

13. *Insulation.*

(a) Material used for insulation shall be such as will not be injuriously affected by atmospheric conditions, or by changes in temperatures between 40 deg. F. below zero and 185 deg. F. above zero.

14. *Dielectric requirements.*

(a) Electrical apparatus assembled shall withstand for 1 minute an insulation test, at place of manufacture, of 3,000 volts a.c. between all parts of electric circuits and other metallic parts insulated therefrom.

(b) A surface leakage distance of not less than $\frac{1}{4}$ in. shall be provided between any exposed metallic part of the apparatus carrying current and any other metallic part thereof.

15. *Identification.*

(a) The covers shall be plainly marked with Manufacturer's references.

16. *Inspection.*

(a) The product furnished under this specification may be accepted upon Manufacturer's certificates of guarantee insuring that it is in accordance with the specification. If on arrival at destination the product is found not to meet the requirements of the specification it may be rejected and Manufacturer, upon request, shall advise Purchaser what disposition is to be made of the rejected product. Manufacturer shall pay all freight charges.

17. *Tests.*

(a) Tests may be made at point of production, or on samples submitted, and may also be made at destination.

(b) Manufacturer shall give Purchaser sufficient notice of time when the material or product will be ready for testing.

(c) Manufacturer shall provide, at point of production, apparatus and labor for making required tests under supervision of Purchaser.

(d) If tests are to be made at point of production, it shall be so stated on Purchaser's order.

18. *Packing.*

(a) Product shall be so assembled or packed as to permit convenient handling and to protect against loss or damage during shipment.

19. *Marking.*

(a) Purchaser's order, requisition and package number, name of Consignor, and name and address of Consignee, shall be plainly marked on outside of packages and on tags attached to loose pieces.

(b) Detail list of loose pieces, packages and their contents shall be furnished for each shipment.

20. *Warranty.*

(a) Manufacturer shall warrant the product covered by this specification to be free from defects in material and workmanship under ordinary use and service, his obligation under this warranty being limited to manufacturing, at point of production, any part or parts to replace those which shall be found defective within 1 year after shipment to Purchaser. This warranty shall not apply to any product which shall have been repaired or altered in any way by anyone other than Manufacturer thereof, so as to affect, in Manufacturer's judgment, its proper functioning or reliability, or which has been subjected to misuse, negligence or accident.

Alternate requisites.

R-7-i.

Controller contacts shall function properly with a maximum longitudinal variation of 3 in. between the two anchors of the controller.

Action Recommended

Acceptance for submission to letter ballot superseding subject-matter in the Manual.

Subject-matter to be Superseded

Specification 130-47—Circuit Controller for Movable Bridges,
Manual Part 48.

PLANS FOR SWITCHES, FROGS, CROSSINGS, SPRING
AND SLIP SWITCHES*

A review by A.R.E.A. Committee 5—Track, of each plan in the revised A.R.E.A. Portfolio of Track Work Plans disclosed a number of minor inconsistencies due mainly to not having revised certain details to agree with similar details approved in other plans in 1952.

While reviewing the plans, it was found that there were 37 plans which required minor changes, some to incorporate previously authorized changes, some to correct inconsistencies with other approved plans, and others to correct drafting or printing errors. In order to reduce the cost of the 1952 Supplement to holders of the Portfolio, an instruction sheet was included with the 1952 Supplement listing these plans with the changes to be made in each, and each purchaser of the Supplement was asked to make the changes himself since only a little work was required.

The following plans were revised and adopted as recommended practice at the A.R.E.A. Annual Meeting in Chicago, Ill. on March 19, 1953:

Plan 190-52—Diagram Illustrating Preferred Names of Parts for Split Switches.

Plan 213-52—11'0" Split Switch Point Derail.

Plan 220-52—Manganese Steel Points for Split Switches.

Plan 490-52—Diagram Illustrating Preferred Names of Parts for Spring Rail Frogs.

Plan 690-52—Diagram Illustrating Preferred Names of Parts for Railbond Manganese Steel Frogs.

Plan 793-52—Data Sheet for A.A.R. Standard Wheel Flanges, Treads and Gages.

†Plan 1001-52—Data for Tee Rail Sections.

†Plan 1004-52—Data for Head Free Rail Sections.

Action Recommended

Acceptance as information.

* Previous report on this subject appears in A.A.R. Signal Section 1951 Proceedings, Vol. XLIX, pp. 63 and 371.

† These plans are for information only.

RECOMMENDED METHODS OF PREVENTION, DETECTION
AND EXTINGUISHMENT OF FIRES IN INTERLOCKING,
CLASSIFICATION YARD AND TRAFFIC CONTROL SYSTEMS

Signal Section Committee II has investigated methods of prevention, detection and extinguishment of fires in interlocking, classification yard and traffic control systems, in collaboration with representatives of the Fire Protection and Insurance Section, A.A.R., and assisted by representatives of manufacturers of fire protection equipment and signal equipment.

The continuity of movement of railroad traffic requires the highest possible reliability of service consistent with economic justification of the costs of such service. This report deals with the fundamentals of fire prevention and fire protection. The most important factor is to give proper consideration to buildings and housings and their contents so that the possibility of fires will be reduced to a minimum. Next in importance is the ability to extinguish such fires that do occur while they are in their early stages.

When any building which houses control facilities is destroyed by fire, the financial loss includes not only the cost of replacing the building and equipment, but also the loss in time and money due to train stops, train delays and manual operation of switches during the period when the control system is out of service.

Many railroads have experienced fires in interlocking stations where the loss of the interlocking equipment was considerably greater than that of the building itself. The loss of a control station in a classification yard will hamper yard operations for an extended period. If the control machine for an extensive traffic control territory is destroyed by fire, several months may be required to manufacture and install a new machine. Furthermore, the operation during the period of reconstruction results in delays to trains. Even if enough operators could be secured to establish offices to authorize train movements by timetable and train order, the delays to trains could be serious.

Fire Prevention by Engineering Design

Within recent years most railroads have adopted the practice of providing control stations of fire-resistive building construction for new interlockings, classification yards and traffic control systems. The location of such buildings should be given careful consideration particularly in reference to the proximity of adjacent tracks and highways in order to insure against involvement of the facility in possible fire damage resulting from train or highway accidents.

Some risk is involved in installing a control machine and its associated equipment in a building of combustible construction. This is due to the presence of heating appliances and combustible material. Fires from outside sources may present even a greater hazard. Therefore, when new machines are installed in existing combustible type buildings, sufficient fire-resistive materials should be applied to minimize the damage by fire.

Regardless of whether the building construction is fire-resistive or only partly so, the next consideration is to minimize the possibility of flammable materials, apparatus and supplies burning within the building. Various types of wire insulation which will not support combustion are now available. Large conduits and wire chases which lead from terminal boxes, and instrument cases or racks on the ground floor of buildings to the machines on the floors above, should be

constructed with fire-resistive materials and arranged to prevent drafts and possible paths for flames. Empty shipping boxes and packing material should not be allowed in any part of buildings used for housing interlocking, car retarder or traffic control machines. Approved containers should be provided for waste and rags. Steel lockers should be provided for storage purposes. Other furnishings and fixtures should be of fire-resistive materials.

Safe Practices

The best assurances against fire are "good housekeeping" and observance of safe practices. Premises should be maintained in a clean and orderly condition at all times. The use of flammable solvents should be prohibited. Welding and cutting operations should be performed under supervision of a responsible and qualified individual. "Rules Governing Fire Prevention and Fire Protection," published by the Fire Protection and Insurance Section, A.A.R., relate to all phases of safe practices and regulations concerning railroad properties in fire prevention and fire protection and should be referred to for additional information.

Training of Personnel

In order for any control station to provide its own fire protection, it is necessary not only to install proper extinguishing equipment but also to train personnel in the proper technique for extinguishing all types and sizes of fires. Every railroad should organize its own fire school where the men can receive the necessary instruction and experience can be had on actual fires under simulated station operating conditions. Lectures should be given on such subjects as various types of extinguishers and elements of combustion.

The men should realize the importance of absolute discipline and the necessity of instant response to a fire alarm. A person who observes a fire should give the alarm immediately, then proceed to attack the outbreak with the fire protection appliances at hand. A qualified person should take charge, putting available men to work, summon assistance if necessary, and attend to prevention of water damage, ventilation, etc.

Portable Fire Extinguishing Equipment

The control facilities in buildings are exposed to fire risks varying in kind and intensity in accordance with the type of structure, material used in construction and the hazards incident to the operations therein performed. Buildings constructed of highly fire-resistive material are, of course, less vulnerable to incipient fire damage whereas wood construction might invite serious loss. Fires are classified according to the hazard involved and adequate protection requires the right type and size of fire extinguisher for each hazard. The following information regarding portable fire extinguishing equipment clearly defines their use, operation and recommended minimum fire protection but it may be desirable to provide more than the minimum on account of the risk involved. In this connection the department having jurisdiction over fire protection should be consulted.

1. Approval.

(a) Fire extinguishers should be of approved type and acceptable to department having jurisdiction.

2. Classification.

(a) Class A fires are fires in ordinary combustible materials where "quenching" and "cooling" effects of quantities of water, or solutions containing large percentages of water, are of first importance. The following appliances are standard for this class:

1. Soda-acid fire extinguisher.
2. Pump-tank fire extinguisher.
3. Foam fire extinguisher.

(b) Class B fires are fires in flammable liquids, greases, etc., where a "blanketing" effect is essential. The following appliances are standard for this class:

1. Foam fire extinguisher.
2. Carbon dioxide fire extinguisher.
3. Dry chemical fire extinguisher.
4. Vaporizing liquid fire extinguisher.

(c) Class C fires are fires in electrical equipment where the use of a "non-conducting" extinguisher is of first importance. The following appliances are standard for this class:

1. Carbon dioxide fire extinguisher.
2. Dry chemical fire extinguisher.
3. Vaporizing liquid fire extinguisher.

3. Number and distribution of extinguishers.

(a) The number of fire extinguishers to be installed should be determined by the department having jurisdiction over fire protection.

(b) The following table shows the characteristics of various types of hand portable extinguishers and the class of fires for which each is suitable.

Common Types of Hand Extinguishers

Type	Capacity**	Classification	Subject to freezing	Conductor of electricity	Horizontal range, ft.
Soda-acid	2½ gal.	A	Yes	Yes	30-40
Pump-tank*	2½ gal.	A	Yes	Yes	30-40
	5 gal.	A	Yes	Yes	30-40
Water-cartridge operated*	2½ gal.	A	Yes	Yes	30-40
Foam	2½ gal.	A, B	Yes	Yes	30-40
	5 gal.	A, B	Yes	Yes	30-40
Vaporizing liquid (pump type)	1½ qt.	B, C	No	No	20-30
	1 gal.	B, C	No	No	20-30
Vaporizing liquid (stored pressure)	2½ qt.	B, C	No	No	20-30
Carbon dioxide	5 lb.	B, C	No	No	4
	15 lb.	B, C	No	No	6
Dry chemical	7½ lb.	B, C	No	No	10
	15 lb.	B, C	No	No	20-25

* These extinguishers can be made non-freezing by use of approved anti-freeze compounds.

** Capacities shown are the most commonly used but other sizes are available.

4. *Inspection, maintenance and operation.*

(a) Soda-acid extinguisher (for Class A fires).

1. This extinguisher is for use on incipient fires in ordinary combustible or free burning material where the cooling effect of water, or solution containing water, is effective. This extinguisher should be given a surface inspection at least once a month, checking by hand weighing as to its being full. Hose should be clear and pliable with no evidence of exterior damage. This extinguisher can be used only where non-freezing temperatures are experienced. It must be recharged annually in accordance with directions on the extinguisher.

Operation: Carry extinguisher by the top handle to the fire. When 10 to 20 feet from the fire, take the hose in one hand, turn the extinguisher upside down, steadying it with the other hand, and direct the stream on the fire. This extinguisher must *not* be used on any fires in and around live electrical equipment or on flammable liquids, greases, or similar materials.

(b) Foam extinguisher (for Class A and B fires).

1. This extinguisher is for use on incipient fires, flammable liquids, greases, and similar materials where the foam generated is utilized to form a covering over the burning surface. It is also of limited use on incipient fires where soda-acid and pump-tank type extinguishers are normally indicated. This extinguisher should be given a surface inspection at least once a month, checking by hand weighing as to its being full. Hose should be clear and pliable with no evidence of exterior damage. This extinguisher can be used only where non-freezing temperatures are experienced. It must be recharged annually in accordance with directions on the extinguisher.

Operation: Carry the extinguisher by the top handle to the fire. When 10 to 20 feet from the fire, take the hose in one hand and turn the extinguisher upside down, steadying it with the other hand. Direct the stream in such a manner so as to permit the foam to settle on the burning surface.

(c) Vaporizing liquid fire extinguisher (for Class B and C fires).

1. This extinguisher is primarily for incipient fires in and around live electrical equipment and is also useful on small oil and grease fires. This extinguisher should be checked monthly as to whether properly filled and also the pumping mechanism should be tried, shaking the extinguisher after trial so as to clear the tip. When refilling is required, use only standard vaporizing liquid base fire extinguisher fluid, **DO NOT** use water at any time.

Operation: Take extinguisher in one hand, catch hold of the handle with other hand, turning handle around to unlock it; pull on handle, and pump the extinguisher as if using a hand pump, directing the stream on the fire where it evaporates and forms a smothering vapor. **CAUTION**—Avoid exposure to fumes.

4. *Inspection, maintenance and operation.*—Continued.

2. This extinguisher is also available in the stored-pressure type (air or carbon dioxide), and the maintenance is similar to that of the type described in paragraph 4-c-1. The stored-pressure type is operated by opening the valve provided on the head castings, using the stored pressure to propel the stream. **CAUTION**—Avoid exposure to fumes.

(d) Carbon dioxide extinguisher (for Class B and C fires).

1. This extinguisher is approved for incipient fires in and around electrical equipment and on small flammable liquid fires. The extinguishing agent is carbon dioxide gas which blankets the fire. Recharging is only necessary after use. It is recommended that extinguisher be weighed at least annually to detect loss of gas, if any. This type of extinguisher is recommended particularly for Class C fires because the gas is a non-conductor and it will not damage electrical equipment, varnish or insulation and will leave no residue.

Operation: The extinguisher is operated by opening a valve. Pressure is created by expansion of gas from a liquefied state.

(e) Dry chemical extinguisher (for Class B and C fires).

1. This extinguisher is approved for incipient fires in and around electrical equipment and on small flammable liquid fires. The extinguishing agent is 95 to 97 per cent powdered sodium bicarbonate, treated with components, which blankets the fire. This extinguishing agent is a non-conductor but it will leave a residue which may interfere with operation of relays or other electrical apparatus. For this reason the use of dry chemical extinguishers should be limited as much as circumstances permit in order to avoid excessive clean up work on electrical apparatus. Recharging is only necessary after use but the extinguisher should be inspected at least annually in accordance with the manufacturer's instructions. Only recharging material furnished by the manufacturer shall be used.

Operation: There are several methods of activation, and manufacturer's instructions on name plate should be followed. The dry chemical is expelled by gas pressure.

(f) Other sizes and types of fire extinguishers designed for special risks may be provided, subject to the approval of the department having jurisdiction over fire protection.

(g) Antifreeze solution.

1. As a freezing preventative for water provided for fire extinguishing devices, commercial 75 per cent calcium chloride should be used.

2. For convenient practice, where temperatures lower than 20 degrees below zero Fahrenheit are encountered, add 5 pounds of calcium chloride to each gallon of water; for temperatures not lower than 20 degrees below zero Fahrenheit, add only 4 pounds to the gallon.

Fixed Carbon Dioxide Fire Extinguishing Systems

Fixed carbon dioxide fire extinguishing systems, supplemented by suitable hand extinguishers, are approved and recommended for extinguishing fires in control stations of interlocking, classification yard and traffic control systems. Such installations consist of one or more cylinders of liquefied carbon dioxide and a suitable piping system terminating with specially designed discharge nozzles in the protected space. Several types of automatic releases are available for actuation of such systems and all systems should be arranged to permit manual operation.

The liquefied carbon dioxide, when released from the high pressure cylinders, has a very high ratio of expansion and cylinders completely empty into the protected area without requiring pumping or other pressure means. The discharge of carbon dioxide gas closely resembles a cloud of steam and it penetrates every nook and corner by the force of its own expansion and extinguishes fire by diluting the oxygen content of a space to a point where it will not support combustion.

Carbon dioxide is a clean, dry, non-corrosive, non-damaging and non-deteriorating, inert gas which will not injure machinery, equipment, woodwork, finishes or fabrics with which it may come in contact. It is a non-conductor of electricity.

Under this class of protection, a reasonably well-enclosed space, room or building is assumed. Rooms, buildings or other enclosures having large openings or forced air ventilating systems require the use of standard equipment for automatically closing such openings or screening them with approved carbon dioxide gas discharge outlets or other approved screening devices or both and for shutting down such forced air ventilating systems before or simultaneously with the operation of the carbon dioxide gas extinguishing system. The protection of openings which have the major portion lower than half the height of the rooms or enclosures is important and may need special attention. The protection of small vents at the top of enclosures may or may not be important. Sometimes they are of value for the escape of air, thereby assisting in the filling of the enclosure with the proper concentration of carbon dioxide and avoiding blowing fire out of the enclosure through other openings by the rapid discharge of the carbon dioxide gas. Openings wider than 8 feet should be protected by other than gas screens, unless local application to the hazard within the space is used. In no case should the total area in square feet of all openings unprotected, unscreened and screened exceed 3 per cent of the volume in cubic feet of the enclosure protected.

In order to detect any fire that might occur within the control station, a number of fire detectors should be installed at strategic locations within the risk. These detectors may be any one of the following types:

1. Fixed temperature.
2. Rate of temperature rise.
3. Combination of fixed temperature and rate of temperature rise.
4. Smoke detection.
5. Flame detection.

The detectors should be arranged to sound an alarm and may be arranged to actuate the carbon dioxide fire extinguishing system described in the foregoing.

To assure that any smouldering or glowing materials are completely extinguished the protected area should be left closed for at least 15 minutes after the flooding system has been operated. The carbon dioxide gas is not poisonous, but it can cause suffocation should a person remain in a heavy concentration for more than a brief period; therefore, the area should be completely ventilated after extinguishment of fire.

Maintenance of Fire Extinguishers

Hand extinguishers.

The use of fire fighting equipment may be required at any time. It is, therefore, important to keep the apparatus in perfect condition at all times. Someone in charge should become fully familiar with the equipment and arrange for required periodical inspection to insure the best service and proper operation of all types of extinguishers provided.

Instructions regarding maintenance must be carefully followed in order that extinguishers will always be fully charged, in their designated places at all times, and in condition to operate efficiently at any moment without delay.

Fixed extinguishing systems.

On automatic systems it is imperative that heat, smoke or flame detectors be installed in accessible locations. These devices must be periodically inspected and cleaned and maintained free of foreign substances at all times. Failure to follow this procedure will seriously impair the efficiency of the automatic feature of the equipment and may result in a failure to detect fire. The frequency of inspection and cleaning of the detectors, in locations which are subject to accumulations of foreign material, must be determined by field requirements.

The following inspection and tests should be conducted by an inspector or person responsible for the care and maintenance of the system, in accordance with the manufacturer's instructions:

1. Check the weight of each cylinder.
2. Inspect and test the operation of the release from each heat actuator with heat.
3. Inspect piping to see that piping and discharge nozzles are in good condition and securely bracketed.
4. Test smoke detector under actual smoke conditions.
5. Test flame detector under actual flame conditions.
6. Verify that the hazard as originally protected by the custom-made installation has not been changed.

Action Recommended

Acceptance as information.

(Revision of A.A.R. Signal Section Specification 208-44)
A.A.R. SIGNAL SECTION SPECIFICATION 208-53.

ALL-RELAY INTERLOCKING CONTROL MACHINE

1. *Purpose.*

(a) This specification is for the purpose of providing for a machine for the control of signals, switches and other apparatus of an all-relay interlocking. It sets forth specific detail requirements representing modern signal practice recommended for new installations and for replacement on existing installations when general renewal or replacement becomes desirable.

2. *Requisites, specifications and drawings.*

(a) Requisites, specifications and drawings referred to in the body of this specification form an essential part hereof.

(b) Manufacturer shall furnish with his tender, drawings forming an essential part thereof.

3. *Tender.*

(a) The tender shall be for a product meeting the requirements of this specification in its entirety.

4. *Purchaser's order requirements.*

(a) The following additional requirements will be shown on Purchaser's order:

1. Track and signal plan drawn to scale.
2. Plan showing tracks, signals, power switches, electric locks on hand-operated switches, and indicator lights to be included on track chart.
3. Track chart location.
4. Designation of levers and other controlling devices, working and spare, and spare spaces.
5. Control panel and desk illumination.
6. Indicator lights other than for track chart.
7. Lamp renewal from front or back of machine.
8. Color for enamel finish.
9. Special features including circuit controllers.
10. Inspection and tests as required.
11. Alternate requisites as required.

5. *Alternates.*

(a) The provisions contained in the alternate requisites section of this specification form a part hereof only when substituted by Purchaser's order for the provisions contained in this specification.

6. *Material and workmanship.*

(a) Material and workmanship shall be first-class in every respect.

7. *Design.*

(a) Machine shall include the following features:

1. Switch, signal, traffic and other levers or controlling devices as required.

2. Circuit controllers as required.

3. Lights for indicating the position of the controlled apparatus.

4. Track chart integral with machine or separately mounted, as specified by Purchaser, and with indicator lights. *R-7-a-4.

5. Power off and on shall be indicated by lights on machine. *R-7-a-5.

6. Maintainer's call. *R-7-a-6.

7. Control panel and desk illumination as specified by Purchaser.

8. Visual or audible indication, or both, for OS reporting.

(b) Like parts of same Manufacturer's machine shall be interchangeable.

(c) Moving parts of machine shall work freely and without excessive lost motion.

(d) Bolts, nuts and threads shall be in accordance with Specifications for Bolts, Nuts and Threads, Manual Part 17.

8. *Levers.*

(a) Switches and signals shall not be controlled from the same lever or controlling device. *R-8-a.

(b) Levers or other controlling devices of like character shall have equal and uniform throw and shall be true in alignment.

(c) Levers or other controlling devices shall be so arranged that they may be removed without interfering with the operation of other levers or other controlling devices.

9. *Relays.*

(a) Relays used as communication apparatus for transmission of controls and indications shall be in accordance with Specification 180, Manual Part 145, or Specification 224, Manual Part 228.

10. *Circuit controllers.*

(a) Contact members shall be made of corrosion-resisting metal of sufficient mechanical strength and current-carrying capacity to satisfactorily operate in connection with the circuits used.

(b) The movement of the contact members shall be such as will provide a wiping contact.

* Alternate requisites section.

11. *Binding posts.*

(a) Binding posts, nuts and washers for field wire connections shall conform to Drawing 1070, assembly 107010.

(b) Binding posts, nuts and washers conforming to Drawing 1070, assembly 10705, 107010, 107020, or soldered terminals, shall be used where no field wires are connected to such terminals.

(c) Binding posts shall be mounted so they cannot be turned in the base or frame to which applied. They shall be properly insulated from each other and other metallic parts.

(d) Binding posts shall be spaced not less than $\frac{7}{8}$ in. centers.

(e) Supports for binding posts shall be of such material that wire connections will not loosen due to shrinkage.

12. *Light indicators.*

(a) Indicators for levers or other controlling devices shall be located in the front of machine immediately below, above or in the levers or other controlling devices. *R-12-a.

(b) Track indicators shall be located on the track chart. *R-12-b.

(c) Other indicators required shall be located as specified by Purchaser.

(d) Indicators shall be designed to permit renewal of lamps from front or back of machine as specified by Purchaser.

13. *Electric lamps.*

(a) Incandescent electric lamps shall be in accordance with Specification 51, Manual Part 91, and conform to Drawings 1541, 1542 and 1543.

14. *Tools.*

(a) Special tools required for the maintenance of the machine shall be furnished by Manufacturer. *R-14-a.

15. *Case.*

(a) Machine shall be enclosed in a metal case which shall have removable covers or panels, or both, of convenient size to permit free access to all parts.

(b) Case shall be equipped with cabinet lock. *R-15-b.

16. *Finish.*

(a) Metal parts shall be protected against corrosion except where such protection will interfere with proper functioning of that part.

(b) Material used for protection against corrosion shall neither soften nor flake under atmospheric conditions between temperatures of 40 deg. F. below zero and 185 deg. F. above zero.

17. *Painting.*

(a) Painting shall be in accordance with Specification 120, Manual Part 110.

* Alternate requisites section.

18. *Coil insulation.*

(a) Coils shall be wound with insulated wire and treated so as not to be injuriously affected by atmospheric conditions or by changes in temperatures between 40 deg. F. below zero and 185 deg. F. above zero.

1. Enameled wire shall be in accordance with Specification 193, Manual Part 183.

2. Cotton-covered wire shall be in accordance with Specification 194, Manual Part 189.

3. Silk-covered wire shall be in accordance with Specification 195, Manual Part 200.

(b) Coils external to the housing of moving parts shall be impregnated by vacuum and pressure with insulating compound in accordance with Requisites for Compound for Impregnation of Electrical Windings, Manual Part 171.

(c) Coils adjacent to moving parts, armature air gaps or contacts shall be treated by impregnation or dipping with insulating varnish in accordance with Requisites for Varnish for Treatment of Electrical Windings, Manual Part 174.

(d) When enamel insulation on No. 16 A.W.G. wire or smaller is used on impregnated coils, a cotton thread shall be placed between layers and built up at each end to a minimum wall thickness of $\frac{1}{16}$ in.

(e) Insulating material used for fillers in winding coils shall be chemically neutral.

(f) Coils shall be so insulated that they will withstand the insulation test provided in section 19. This test shall be made by mounting coil on a snugly fit metal mandrel and making breakdown tests between mandrel and winding; also by standing coil on each end in turn on a metal plate and testing between plate and winding.

19. *Dielectric requirements.*

(a) Electrical apparatus assembled shall withstand for 1 minute an insulation test, at place of manufacture, of 1,500 volts a.c. between all parts of electric circuits and other metallic parts insulated therefrom, except lamp receptacle which shall withstand for 1 minute an insulation test of 800 volts a.c.

(b) A surface leakage distance of not less than $\frac{1}{8}$ in. shall be provided between any exposed metallic part of the apparatus carrying current and any other metallic part thereof.

(c) Separate windings, which are insulated from each other, shall withstand for 1 minute an insulation test of 1,500 volts a.c. between their terminals.

20. *Identification.*

(a) Machine, magnet coils and resistors shall be plainly marked with Manufacturer's references.

21. Inspection.

(a) Purchaser may inspect the material or product at all stages of manufacture.

(b) Purchaser may inspect the completed product to determine that the requirements of this specification have been met.

(c) If product has not been accepted at point of production and if, upon arrival at destination, it does not meet the requirements of this specification, it may be rejected, and Manufacturer, upon request, shall advise Purchaser what disposition is to be made of the rejected product. Manufacturer shall pay all freight charges.

(d) If Purchaser is to make inspection at point of production it shall be so stated on Purchaser's order.

22. Tests.

(a) Tests may be made at point of production, or on samples submitted, and may also be made at destination.

(b) Manufacturer shall give Purchaser sufficient notice of time when the material or product will be ready for testing.

(c) Manufacturer shall provide, at point of production, apparatus and labor for making required tests under supervision of Purchaser.

(d) If tests are to be made at point of production, it shall be so stated on Purchaser's order. Purchaser shall indicate which of the tests herein specified are to be made and what portion of the material or product shall be tested.

23. Packing.

(a) Product shall be so assembled or packed as to permit convenient handling and to protect against loss or damage during shipment.

24. Marking.

(a) Purchaser's order, requisition and package number, name of Consignor, and name and address of Consignee, shall be plainly marked on outside of packages and on tags attached to loose pieces.

(b) Detail list of loose pieces, packages and their contents shall be furnished for each shipment. Where carload shipments are made, routing and car identification shall be shown.

25. Warranty.

(a) Manufacturer shall warrant the product covered by this specification to be free from defects in material and workmanship under ordinary use and service, his obligation under this warranty being limited to manufacturing, at point of production, any part or parts to replace those which shall be found defective within 1 year after shipment to Purchaser. This warranty shall not apply to any product which has been subjected to misuse, negligence or accident.

Alternate requisites.

R-7-a-4.

Track chart shall not be provided.

R-7-a-5.

Power off and on shall not be indicated by lights on machine.

R-7-a-6.

Maintainer's call shall not be provided.

R-8-a.

Switches and signals shall be controlled from levers or controlling devices as specified by Purchaser.

R-12-a.

Indicators for levers or other controlling devices shall be located.....

R-12-b.

Track indicators shall be located.....

R-14-a.

Special tools required for the maintenance of the machine shall be furnished by Purchaser.

R-15-b.

Case shall be arranged for Purchaser's padlock.

Action Recommended

Acceptance for submission to letter ballot superseding subject-matter in the Manual.

Subject-matter to be Superseded

Specification 208-44—All-Relay Interlocking Control Machine,
Manual Part 210.

PROGRESS REPORT

SPECIFICATIONS FOR ELECTRICAL HEATERS FOR TRACK SWITCHES*

In 1945 the Signal Section requested the Electrical Section of the Engineering Division, A.A.R. to prepare specifications for electric switch heaters. The subject was assigned to Electrical Section Committee 5—Electric Heating and Welding, in collaboration with Signal Section Committee II. As a result, Specifications for Electric Heaters for Track Switches, Tubular Type, were prepared, approved by letter ballot and now appear in the Electrical Section Manual (5-B-46).

Subsequently, the Signal Section requested the Electrical Section to prepare supplemental specifications for the installation of electric heaters for track switches, tubular type, in collaboration with Committee II.

At the 1952 Annual Meeting of the Electrical Section held in Chicago on September 15, 16 and 17, 1952, revised Specifications for Electric Heaters for Track Switches, Tubular Type, and Specifications for Installation of Electric Heaters for Track Switches, Tubular Type, were presented and approved for submission to letter ballot replacing specifications in the Electrical Section Manual (5-B-46).

At a meeting of Electrical Section Committee 11—Electric Heating, held in Baltimore, Md., on March 24, 1953, specifications were prepared covering electric heaters for application to the ballast under track switches to furnish supplementary heat under unusually severe weather conditions to keep switch rods and switch points free of snow and ice when the tubular type heaters applied to the rails alone may be inadequate. The ballast heater consists of a tubular type heater element in hair-pin form clamped between two corrosion-resistant shoes or plates which serve as heat-conducting and radiating surfaces. These specifications are to be presented for discussion and if approved, for submission to letter ballot, at the 1953 Annual Meeting of the Electrical Section to be held in Atlantic City, N. J. on June 24, 25 and 26, 1953.

During the Winter of 1952-53, Electrical Section Committee 11 conducted field tests on three railroads in Illinois, New York and Pennsylvania to obtain comparative data of rail temperatures at various points on track switches equipped with electric snow melting heaters. Certain switches were equipped with graduated heaters which provide additional heat in the switch point, and other switches were equipped with the A.A.R. one-rating tubular type heater. Recording pyrometers were installed with thermo-couples arranged to determine simultaneously the ambient temperature, temperature of ballast, and the temperatures of stock rail and switch point, respectively, at locations 2 feet ahead of switch point, at switch point and at three definite locations behind the switch point, the spacing depending upon the length of the switch point. The thermo-couples were attached to the base of the stock rail adjacent to the fillet on the outside of track and those on the switch points were placed halfway out on the base on the inside of track.

* Previous report on this subject appears in A.A.R. Signal Section 1946 Proceedings, Vol. XLIV, pp. 70-A₂ and 357-A.

The area of rail around the thermo-couple location was well cleaned with gasoline and wire brush. Then, a smaller area was polished with a small hand grinder. The thermo-couple made up of No. 22 copper Constantine wire was placed on the polished spot and covered with Mystik tape to hold the couple firmly against the rail for temperature transfer. Over the tape was then placed an application of hot Petrosene wax or similar material.

The purpose of the tests was to obtain some scientific knowledge of the adequacy of the heater ratings during severe snow, wind, and temperature conditions. Some interesting and useful data was taken but because of the comparative mildness of the winter, the tests are to be continued.

Action Recommended

Acceptance as information.

COMMITTEE III—SIGNAL SHOP PRACTICE

Personnel

P. P. Ash, Chairman

A. M. Weeks, Vice-Chairman

D. C. Bettison	M. A. Nyberg
E. L. Brock	W. Poole
E. R. Frachiseur	J. P. Stevely
I. E. Harshbarger	H. V. Stone
J. E. Hillig	R. E. Testerman
L. G. Hogan	W. M. Vogts
E. C. Jackson	J. F. Yerger
J. G. Karlet	E. H. Branson*
A. C. Krout	A. W. Fisher*

Signal Section, A.A.R.:

The following outline of work has been assigned:

1. Revision of Manual.
2. Indexing signal literature.
3. Investigate and report on the factors involved in the establishment of repair facilities.
4. Shop practices and facilities used in testing and repairing spring switch buffers.
5. Economic advantages of signal shops.
6. Investigate and report on modern shop practices.
7. Investigate and report on methods of handling materials between signal shop and field forces.
8. Investigate and report on the reclamation or repairs of:
 - (a) Signal apparatus.
 - (b) Insulated track fittings.

The Committee submits for consideration, reports on the following subjects**:

3. Factors involved in the establishment of repair facilities.
 4. Shop practices and facilities used in repairing spring switch buffers.
 8. Shop practices and facilities for test and repair of switch circuit controllers.
- Salvaging or repairing of signal material.
- Cooperative report. Purchases and Stores Division, A.A.R. General Reclamation Committee.

* Consulting Member.

** Suggestions or criticisms should be submitted in writing to the Chairman of the Committee on or before August 28, 1953.

FACTORS INVOLVED IN THE ESTABLISHMENT OF
REPAIR FACILITIES**Lehigh Valley Signal Repair Shop.*

An inspection was made of the Lehigh Valley R.R. signal shop layout, located at Sayre, Pa. This signal shop consists of two buildings. The main portion of it is located in the southwest section of the former passenger car paint shop and consists of approximately 22,200 square feet of floor space or about half the entire area of the building. The other building consists of approximately 3,044 square feet of floor space and was formerly a wheel shop. Layout of these buildings as indicated on signal shop layout plan and equipment is listed in Table II.

The shop force consists of 24 people as follows:

- 1 Signal Shop Supervisor
- 1 Leading Signalman
- 15 Signalmen
- 1 Sheet Metal Tinner
- 1 Sheet Metal Tinner Helper
- 5 Signal Helpers

This shop was opened June 1944, in the enclosed section now used as a drafting room, with a force of one supervisor, three signalmen and two signal helpers. The work at that time was confined to repairing relays, signal mechanisms and train control inductors, but was expanded as rebuilding and modernization programs got under way.

Since the shop expanded more rapidly than floor space was available, every effort had to be made to handle material in the most efficient manner possible. An assembly line set-up handled the steady incoming flow of work with efficiency and safety to the employees.

The incoming and outgoing material through the shop is handled by a Stores Department Stockkeeper who, with material racks, skids, etc., is located in the portion of the shop suitable for storage and accessible to the shipping wharf.

The shop rehabilitates all material sent in from the field which is usable, and repaired items are then returned to the Stores Department for stock. In addition, the shop fabricates and assembles many items as will be noted in Table I. Fabrication activity was considered necessary to meet the time limits that were set up for the rebuilding program.

In addition to the work performed exclusively for the Signal Department, special repairs and construction are done for other departments because of special equipment in the signal shop, not duplicated by the other departments, such as spot welding, sand blasting and concrete pouring and casting equipment; and, in turn, some signal material is handled by the Maintenance of Equipment Department because of their available equipment such as electric ovens and magniflux equipment, the latter having proved most efficient in detecting defective castings.

The wiring department of the signal shop does the wiring of all cases, battery boxes and instrument housings for the construction forces on the entire

* Previous report on this subject appears in A.A.R. Signal Section 1951 Proceedings, Vol. XLIX, pp. 64 and 369.

system. This allows the finished unit to be thoroughly tested on shop testing equipment.

It is the policy of the shop supervisor to rotate jobs in the shop at least every 6 months, giving opportunity to shop employees to familiarize themselves with design, repairs and circuit functions of all signal equipment.

TABLE I

Items Fabricated or Repaired in Signal Shop

- Relays—all types
- Searchlight signal mechanisms
- Semaphore signal mechanisms
- Automatic gate mechanisms (road gates) (sidewalk gates)
- Electric switch machines
- Switch motors
- Train control inductors
- Switch circuit controllers
- Dry copper oxide rectifiers
- Signal transformers
- Switch machine controllers
- Battery racks
- * Battery boxes
- * Signal cases and housings
- * Precast foundations
- * Relay case posts
- * Switch plates built to L.V. standard switch layout
- * Terminal boxes for signal and telegraph and telephone equipment
- * Wayside telephone boxes
- Hand bonding machines
- Power bonding machines
- * Motor truck bodies—Signal and Communications Depts.
- * Pole trailers—Communications Dept.
- * Speed signs
- * End of block signs
- * Switch lamps (kerosene)
- * Switch lamps (electric)
- Cast-iron battery box for electric switch lamp
- * Adapters for electric switch lamps
- * Cantilever masts for highway crossing protection installations
- * Signal masts
- * Signal ladders
- Interlocking machines (mechanical and electric)
- * Track model diagrams
- * Special cable and wire ways for Signal, Communications and Electrical Depts.
- * Light signal background
- * Light signal hoods
- * Cable reel jacks
- * Sag gages—Communications Dept.
- * Transfer racks—Communications Dept.

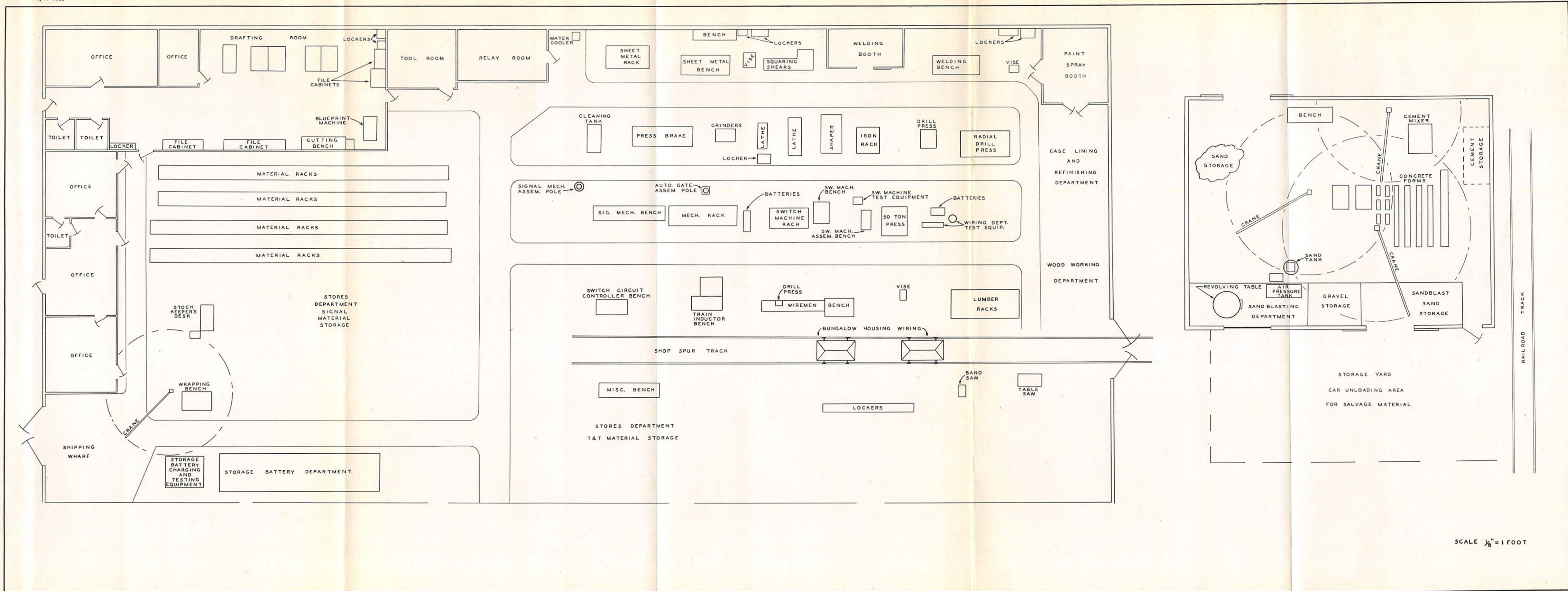
* Items marked thus are completely fabricated in the Signal Shop.

TABLE II
Shop Requirement

- 1—6' squaring shear
- 1—12' 95-ton press brake
- 1—20" bar folder
- 1—30" set of hand rolls
- 1—12-gage electric shear
- 1—14-gage electric shear
- 1—100-ampere spot welder
- 1—400-ampere electric welder
- 2—Complete sets of acetylene portable welding and burning outfits
- 1—Pneumatic press (50-ton capacity)
- 1— $\frac{3}{4}$ " double spindle drill press
- 1—3" radial drill press
- 1—Bench drill press
- 1—18" x 5' engine lathe
- 1—10" x 4' lathe
- 1—24" shaper
- 1—12" bench table saw
- 1—12" band saw
- 1—10" motor-driven bench grinder (double wheel)
- 1—6" motor-driven bench grinder (double wheel)
- 1—8" motor-driven wire brush and buffing head
- 1— $\frac{1}{2}$ " electric drill
- 2— $\frac{3}{8}$ " electric hand drills
- 1—Impact wrench
- 1—Electric hammer
- 1—Portable grinder, 6,000 r.p.m.
- 1—Electric soldering gun
- 5—7" bench vises and stands
- 1—4" x 42" hollow mandrel
- 10—Pairs wire strippers
- 1—Electric-driven cement mixer
- 1—1-ton capacity sand blasting equipment with revolving table (shop built)
- 1—Portable test set (volt-ammeter combination)
- 1—Rheometer
- 1—500-volt insulation resistance tester
- 2—D.C. volt-ammeters 3-3-30
- 1—D.C. voltmeter 0-50
- 1—D.C. milliammeter 15-50-500
- 1—D.C. voltmeter 1-10-50
- 1—A.C. voltmeter 0-250
- 1—A.C. ammeter 0-50
- 1—Electric lift truck
- 1—5-ton electric mobile crane
- 1—1-ton electric hoist
- 2—2-ton pneumatic hoists
- 1—1-ton hand chain hoist
- 1— $\frac{1}{2}$ -ton hand chain hoist
- 1—6-ton hand chain hoist
- 1—6-ton automobile truck

Action Recommended

Acceptance as information.



SHOP PRACTICES AND FACILITIES USED IN REPAIRING SPRING SWITCH BUFFERS

The Committee found considerable variance in maintenance requirements for spring switch buffers ranging from those left in service as long as they would meet a field test to regularly cycled replacement at periods determined by their use. One railroad cycle-changes at 2-year intervals all spring switch buffers used at end of two main tracks and completely dismantles them in the reconditioning process. It reports that this has practically eliminated any failures. Where buffers are used on switches at the end of sidings, the cycle-change period is increased to 4 years.

Regardless of the field requirements, the repair and reclamation of a spring switch buffer in the shop involves dismantling, making necessary inspections and replacements, reassembling and testing. The number of buffers to be repaired does not normally justify a full-time assignment; this class of work is usually established as a part-time job for men engaged in similar work. Following is a typical set-up:

1. *Organization.*

(a) The personnel should be trained in the testing and repair of spring switch buffers.

(b) Instructions and specifications for repairing, adjusting and testing spring switch buffers should be provided.

(c) Instructions should be provided on the method of determining which spring switch buffers should be repaired. (See "Salvaging or Repairing of Signal Material," page 59.)

2. *Shop space.*

(a) Adequate shop space should be provided for the permanent installation of the necessary equipment which will be used solely for spring switch buffer repair and testing work at a location convenient to shop tools which are jointly used on other repairs.

(b) Normal shop illumination should be adequate.

3. *Equipment.*

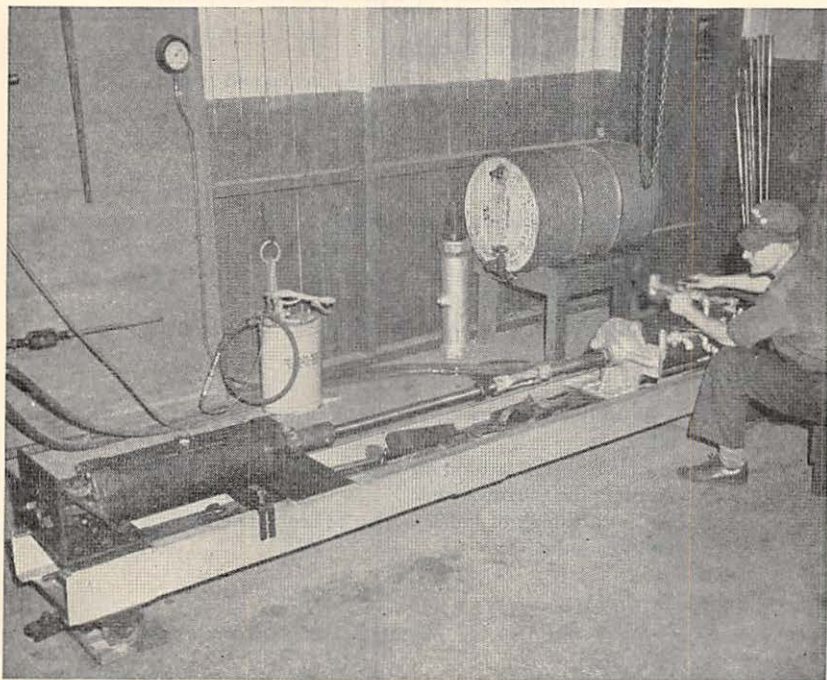
(a) The following equipment is considered essential to be used solely for repair and testing of spring switch buffers:

1. Pneumatic test bench permitting 6-inch piston travel either side of neutral center position with 3,000 pounds pressure on piston rod.
2. Necessary facilities for spring loading and buffer action tests with tolerance chart.
3. Necessary facilities for replacing worn bushings.
4. Hoist with 500-pound capacity.
5. Special lift tongs for handling buffer.
6. Cleaning tank for small parts.
7. Parts and scrap bins.
8. Work bench on wheels with cradle top for buffer rest.
9. Piston ring compression tool.
10. Buffer fluid reservoir with hose and valve connection.
11. Hand tools, gages, etc.

3. *Equipment.*—Continued.

(b) The following equipment is considered essential but may be used jointly on other repair work:

1. High pressure air supply (90-pound minimum pressure).
2. Suitable cleaning facilities.
3. Impact wrench.
4. Lathe or similar turning tool.
5. Buffing wheel.
6. Suitable hydraulic or mechanical press.



Example of test bench used in testing one type of spring switch buffer.

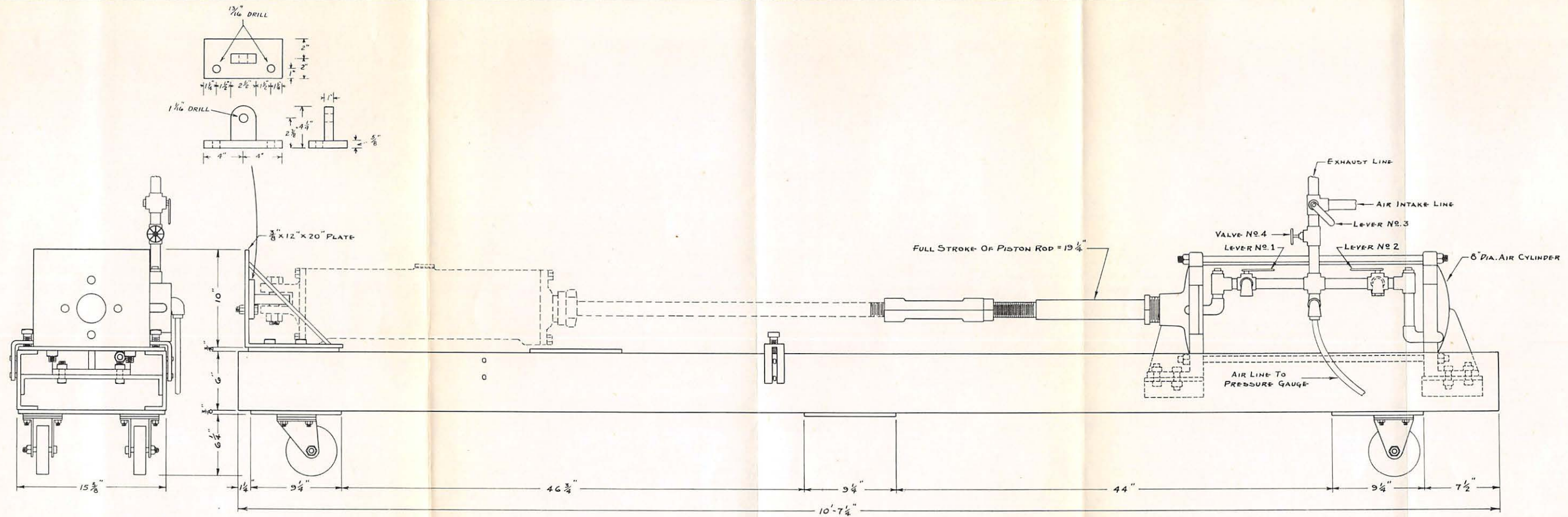
4. *Spring switch buffer repair procedure.*

Step 1. Receipt of buffer at the shop.

Remove from shipping container. Classify for repair or scrap.
Place in classified storage.

Step 2. Preliminary cleaning.

Put assembled buffer through cleaning process to remove surface oil and grease, then move to shop space. (Work bench on wheels provides conveyance.)



LEVER NO.1 AND NO.2 POINTING TOWARD EACH OTHER
LEVER NO.3 POINTING TO RIGHT
VALVE NO.4 OPEN
WILL CAUSE PISTON OF MACHINE TO BE PUSHED OUT
WHICH WILL PUSH SWITCHMAN SHAFT IN

LEVER NO.1 AND NO.2 POINTING AWAY FROM EACH OTHER
LEVER NO.3 POINTING TO RIGHT
VALVE NO.4 OPEN
WILL CAUSE PISTON OF MACHINE TO BE PULLED IN
WHICH WILL PULL SWITCHMAN SHAFT OUT

LEVER NO. 3 POINTING TO LEFT
VALVE NO. 4 OPEN
WILL RELEASE AIR IN CYLINDER

4. *Spring switch buffer repair procedure.*—Continued.

Step 3. Dismantling.

Dismantling procedure should follow manufacturer's recommendations or instructions. To avoid personal injuries, special precautions should be taken to provide adequate holding facilities when releasing or compressing springs.

As parts are dismantled, they should be placed in tank of cleaning fluid and, after being cleaned, given a visual inspection. Serviceable parts from buffers previously classified as scrap should be recovered and all other parts placed in scrap bin. Springs must meet compression test requirements to be serviceable.

Step 4. Cleaning and parts assembly.

Buff contact surfaces of cylinder heads and replace worn bushings. Replace piston rod packing. Polish piston rod. (Scrap-bent or damaged rods.)

Step 5. Assembly.

Assembly procedure should follow manufacturer's recommendations or instructions. To avoid personal injuries, special precautions should be taken to provide adequate holding facilities when releasing or compressing springs.

Fill cylinder with buffer fluid and lubricate packing gland.

Step 6. Testing.

With buffer on test bench, check piston travel for smooth operation.

Check spring tension on both push and pull stroke to see that it meets the tolerance chart.

Check timing of buffer action to see that time is within specified tolerance.

Step 7. Recording.

Make records, tag or mark buffer in accordance with instructions.

Action Recommended

Acceptance as information.

SHOP PRACTICES AND FACILITIES FOR TEST AND REPAIR
OF SWITCH CIRCUIT CONTROLLERS1. *Organization.*

(a) The number of switch circuit controllers to be repaired may not require a full-time assignment to this class of work. After the approximate number to be handled has been established and the average time per controller has been determined, a force can be set up to take care of the requirements.

(b) Instructions and specifications for repairing, adjusting and testing should be provided.

(c) Instructions should be provided on the method of determining which controllers should be repaired. (See "Salvaging or Repairing of Signal Material," page 59.)

2. *Shop space.*

(a) Provision should be made for adequate work space for the force required.

(b) Repair section should be clean and well lighted with work benches arranged at a comfortable height.

3. *Equipment.*

(a) The following equipment is considered essential:

1. Hand tools, contact benders, gages, etc.
2. Scales for testing contact pressure.
3. Dry air supply with small hand blow gun.
4. Portable electric drill.
5. Drill press.
6. Grinding and buffing wheels.
7. Vats for cleaning solution.
8. Welding equipment.
9. Dielectric testing equipment.
10. Direct reading ohmmeter.
11. Work benches, storage racks and bins.

4. *Repair and test procedure.*Step 1. *Inspection.*

Visual inspection for classification of repairs, salvage or scrap.

Controllers to be repaired or salvaged should be placed in classified storage.

Step 2. *Dismantling.*

Controllers should be delivered to work bench and dismantled as indicated by repair classification.

Dismantled parts should be given a visual inspection and worn or damaged parts set aside for repairs or replacement.

All usable parts should be carefully cleaned and care taken that electrical contacts and insulation are not subjected to any cleaning solution which might affect the dielectric qualities or cause electrolytic action between dissimilar metals.

Bearing surfaces should be checked to determine that wear is within tolerance limits.

4. *Repair and test procedure.*—Continued.

Step 3. Assembly.

Housing should be painted in accordance with instructions.

Contacts should be checked to determine that tips are properly fastened to springs and free from burrs or pits, then reassembled on terminal boards and adjusted to give proper alignment, making sure that rollers, when used, operate freely.

Operating shaft should be installed in housing using matched operating cams.

Terminal board should be given a dielectric test between terminal posts and requirements met before being installed in housing.

Cover gasket must be in good condition and properly secured in cover.

Step 4. Testing.

Operating arm should be moved through entire revolution to check for smooth operation with no undue lost motion.

Contacts should be checked for proper alignment and operation.

Visual inspection should be made to ascertain that all cotters are properly installed, lubrication fittings in place, operating arm and all other parts securely fastened with proper clearances.

Dielectric check of completed assembly should be made to determine that it meets requirements.

Cover and hasp assembly should be checked to make certain that it provides a dust-tight closure.

Ventilators should be checked to make certain that they are in proper condition.

Step 5. Preparing for shipment.

After assembly and tests, exterior surfaces should be painted in accordance with instructions and operating arm secured to prevent movement in transit.

Make records, tag or mark controller in accordance with instructions.

Action Recommended

Acceptance as information.

SALVAGING OR REPAIRING OF SIGNAL MATERIAL*

1. All signal material available for repairs generally falls into two classifications:

(a) Material which should not be repaired:

1. Obsolete material not approved for reuse.
2. Material which experience has shown cannot be economically repaired.
3. Material which is so badly damaged that repairs are not justified.

(b) Material where cost of repairs and life expectancy compared with cost and life expectancy of new material indicate that repairs might be justified. The justification should be determined as follows:

1. Policy to be followed for repairs to a device should be governed by the average cost of such repairs over a given period.

2. A fixed percentage of the cost of new material should be established, based on past experience as a limit beyond which repairs are not justified. Generally this percentage will range from 50 to 80 per cent of the new cost of like material.

(a) If inspection indicates a cost less than the established percentage, then repairs are justified.

(b) If inspection indicates a cost equal to or greater than the established percentage, material should not be repaired, unless special consideration justifies.

3. Life expectancy of repaired material should be compared with life expectancy of new material. Under normal circumstances certain materials or devices should not be repaired even when the repair value is within the approved limit as illustrated in the following example:

Example:

The cost of a piece of new material might be \$50 with a life expectancy of 5 years, while the cost of repairing a like piece of used material would be \$30 with a life expectancy of $2\frac{1}{2}$ years. The labor cost of field replacement might be \$3. In this instance, the cost of the new material in place over a 5-year period would be \$53 while the cost of the repaired material in place would be \$66.

2. Material which has been classified as indicating that repairs might be justified should be given a visual inspection by an employee qualified to establish the type of repairs necessary. Type of repairs can be divided into three general classifications, with an additional classification provided for material which should not be repaired:

(a) Minor repairs. Replacement of defective or damaged part or replacement of obsolete detail parts not requiring extensive dismantling.

* Previous report on this subject appears in A.A.R. Signal Section 1949 Proceedings, Vol. XLVII, pp. 96 and 304.

(b) General repairs. Dismantling into component assemblies and replacement or repair of one or more of such assemblies.

(c) Major repairs. Complete dismantling into detail parts with subsequent repair or replacement of such parts.

1. Experience will develop that minor or general repairs to certain items of material are justified but that major repairs are not.

(d) Salvage. Recovery of usable parts from material which should not be repaired, as determined by experience. (An example might be the motor or circuit controller from a broken switch mechanism.)

When material has been classified, it should be segregated and tagged to show classification of repairs so that items of material requiring similar repairs can be worked at the same time.

3. Repair work should include replacement of obsolete detail parts and inclusion of revised or new details that are available for improved performance.

4. All apparatus which is repaired shall be assembled, adjusted and tested in accordance with A.A.R. Signal Section instructions, or manufacturer's specifications.

Action Recommended

Acceptance as information.

COOPERATIVE REPORT

PURCHASES AND STORES DIVISION, A.A.R. GENERAL RECLAMATION COMMITTEE†

P. P. Ash, Representative

The General Reclamation Committee has reported on means of economically reclaiming additional materials as well as bringing up-to-date previous rules and practices for the materials handled by the Stores Department.

As to reclaiming items pertaining to the Signal Section, the General Reclamation Committee has reviewed reports of Signal Section Committee III—Signal Shop Practice, and will continue to review future reports to secure coordination with the Signal Section.

Action Recommended

Acceptance as information.

† Previous report on this subject appears in A.A.R. Signal Section 1951 Proceedings, Vol. XLIX, pp. 74 and 369.

COMMITTEE IV—AUTOMATIC BLOCK SIGNALING

Personnel

L. B. Yarbrough, Chairman

F. L. Chatten, Vice-Chairman

C. M. Acker	W. T. Lewis
R. B. Amsden	P. H. Linderoth
J. A. Beoddy	C. F. Nelson
L. S. Bottinelli	S. E. Noble
W. L. Dayton	D. H. Steiner
E. N. Fox	H. G. Stiebeling
J. R. Heisler	R. E. Taylor
H. Jensen	W. G. Trost
A. L. Jordan	W. L. Waleen
J. C. Koch	R. E. Wall

Signal Section, A.A.R.:

The following outline of work has been assigned:

1. Revision of Manual.
2. Indexing signal literature.
3. Report on protection against lightning.
4. Investigate and report on methods of improving shunting of track circuits.
5. Investigate and report on means and methods for the improvement of track circuit rail bonding used in signaling, collaborating with Committees I and V.
6. Investigate and report on the installation and maintenance of insulated rail joints, collaborating with A.R.E.A. Committee 5.
7. Investigate and report on the use of track instruments instead of track circuits for the release of electric switch locks and electric locking.
8. Investigate and report on the use of high-voltage lightning arresters—various voltage ranges.
9. Investigate and report on the practicability of in-service tests of all types of lightning arresters.
10. Prepare charts and data for ambient temperature correction of relay calibration values.
11. Investigate and report on effectiveness in minimizing condensation and frost in switch circuit controllers by raising the controller box off the tie.
12. Performance specification for solderless type connectors for use in wiring signal apparatus (various size conductors).
13. Specification for screw locks and signal padlocks for outside use.
14. Requisites for discharge resistors.
15. Requisites for surge protector for low-voltage apparatus.
16. Investigate and report recommendations for appropriate field test for survey of interference with track circuits due to cathodic protection on pipe lines paralleling a railroad or on other underground structures adjacent to right-of-way.
17. Investigate and report on methods and devices on single unit self-propelled cars equipped with disc brakes to improve shunting of track circuits, collaborating with Mechanical Division, A.A.R.

The Committee submits for consideration, reports on the following subjects*:

1. Revision of A.A.R. Sig. Sec. 7004, Manual Part 206.
Revision of Specification 95-44, Manual Part 49.
Revision of A.C. Track Circuit Characteristics, Manual Part 161.
Revision of Specification 84-44, Manual Part 165.
8. Use of high-voltage lightning arresters—various voltage ranges.
11. Effectiveness in minimizing condensation and frost in switch circuit controllers by raising the controller box off the tie.
14. Requisites for discharge resistors.
17. Methods and devices on single-unit self-propelled cars equipped with disc brakes to improve shunting of track circuits.

Information

Specifications, etc., of other organizations referred to in the report of this Committee may be procured from the following:

A.S.A.—American Standards Association, 70 E. 45th St., New York 17, N.Y.
N.E.M.A.—National Electrical Manufacturers Assn., 155 E. 44th St.,
New York 17, N.Y.

Disposition of 1952 Letter Ballot Subject

The following subject presented by Committee IV at the 1952 Annual Meeting was submitted to letter ballot and officially approved:
Specification 83-52—Transformer, Dry-Type Self-Cooled—Now in Manual Part 164.

A.A.R. SIG. SEC. 7004 (Sheets 1 and 2).

FOULING PROTECTION FOR TURNOUTS AND CROSSOVERS

A.A.R. Sig. Sec. 7004 has been brought up-to-date to bring it in line with current practice and to provide for higher speed turnouts and crossovers.

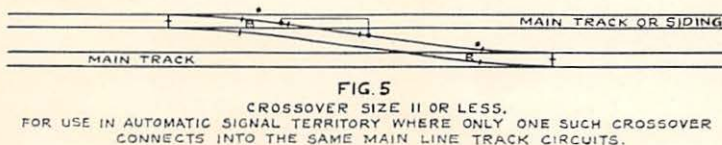
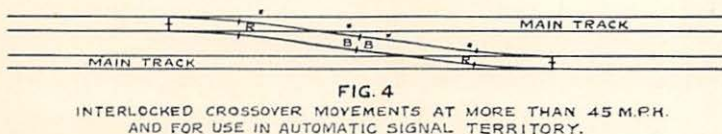
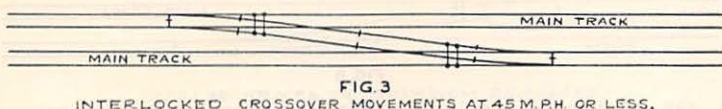
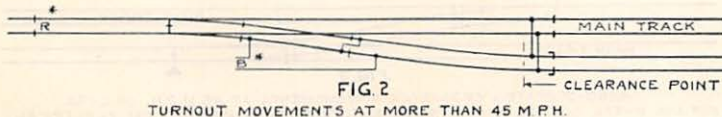
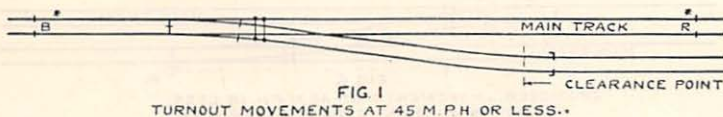
Action Recommended

Acceptance for submission to letter ballot superseding subject-matter in the Manual.

Subject-matter to be Superseded

A.A.R. Sig. Sec. 7004—Fouling Protection—Turnouts and Crossovers,
Manual Part 206.

* Suggestions or criticisms should be submitted in writing to the Chairman of the Committee on or before August 28, 1953.



NOTES:-

1. OTHER ARRANGEMENTS OF FOULING PROTECTION MAY BE USED IN ACCORDANCE WITH INDIVIDUAL RAILROAD PRACTICES, OR AS REQUIRED BY SPECIAL CONDITIONS, BUT SHOULD INCLUDE THE BASIC PRINCIPLES SHOWN IN APPLICABLE DIAGRAM.
2. IN LOCATING INSULATED JOINTS CONSIDERATION MUST BE GIVEN TO MINIMUM WHEEL BASE, MAXIMUM CLEAR SPAN AND LATERAL CLEARANCE OF EQUIPMENT.
3. THESE METHODS OF FOULING PROTECTION APPLY TO EITHER AC OR DC TRACK CIRCUITS WHERE ELECTRIC PROPULSION IS NOT INVOLVED.
4. BONDING AND CROSS CONNECTIONS SHALL BE INSTALLED IN ACCORDANCE WITH SPECIFICATION 135 MANUAL PART 22.
5. INSULATED JOINTS SHALL BE LOCATED IN CONFORMANCE WITH DRAWING 1634 AND 1635.
6. ELECTRIC LOCKS ON HAND-OPERATED SWITCHES ARE SHOWN ONLY WHERE THEY HAVE A BEARING ON FOULING PROTECTION REQUIREMENTS.

* LOCATION OF B (TRACK FEED) AND R (RELAY) MAY BE REVERSED.

AAR
SIG. SEC.
7004

FOULING PROTECTION FOR TURNOUTS AND CROSSOVERS

MAR 1926 | SEPT 1926 | MAR 1927 | M-1527 | SEPT 1953

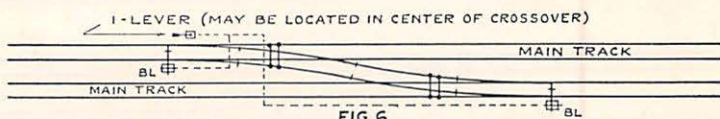


FIG. 6
CROSSOVER MOVEMENTS AT 45 M.P.H. OR LESS.
FOR USE IN AUTOMATIC SIGNAL TERRITORY.

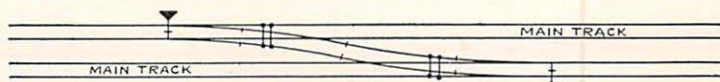


FIG. 7
HAND-OPERATED CROSSOVER MOVEMENTS AT 45 M.P.H. OR LESS.
FOR USE WHERE CONTROL CIRCUITS FOR ELECTRIC LOCKS PROVIDE THE ELECTRICAL
EQUIVALENT OF THE ARRANGEMENT SHOWN IN FIG. 6.

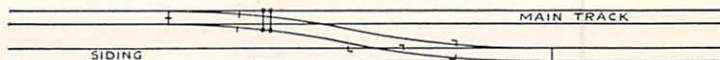


FIG. 8
CROSSOVER MOVEMENTS AT 45 M.P.H. OR LESS.
FOR USE IN AUTOMATIC SIGNAL TERRITORY WHERE ONLY ONE SUCH
SIDING CROSSOVER CONNECTS INTO THE SAME MAIN TRACK CIRCUIT.

NOTES:-

- 1- OTHER ARRANGEMENTS OF FOULING PROTECTION MAY BE USED IN ACCORDANCE WITH INDIVIDUAL RAILROAD PRACTICES, OR AS REQUIRED BY SPECIAL CONDITIONS, BUT SHOULD INCLUDE THE BASIC PRINCIPLES SHOWN IN APPLICABLE DIAGRAM.
- 2- IN LOCATING INSULATED JOINTS CONSIDERATION MUST BE GIVEN TO MINIMUM WHEEL BASE, MAXIMUM CLEAR SPAN AND LATERAL CLEARANCE OF EQUIPMENT.
- 3- THESE METHODS OF FOULING PROTECTION APPLY TO EITHER AC OR DC TRACK CIRCUITS WHERE ELECTRIC PROPULSION IS NOT INVOLVED.
- 4- BONDING AND CROSS CONNECTIONS SHALL BE INSTALLED IN ACCORDANCE WITH SPECIFICATION 135 MANUAL PART 22.
- 5- INSULATED JOINTS SHALL BE LOCATED IN CONFORMANCE WITH DRAWING 1634 AND 1635.
- 6- ELECTRIC LOCKS ON HAND-OPERATED SWITCHES ARE SHOWN ONLY WHERE THEY HAVE A BEARING ON FOULING PROTECTION REQUIREMENTS.

AAR
SIG. SEC.
7004

FOULING PROTECTION FOR TURNOUTS AND CROSSOVERS

MAR 1926 | SEPT 1926 | MAR 1927 | M-1927 | SEPT 1953

METHODS AND DEVICES ON SINGLE UNIT SELF-PROPELLED CARS EQUIPPED WITH DISC BRAKES TO IMPROVE SHUNTING OF TRACK CIRCUITS

Signal Section Committee IV has investigated methods and devices applied to single unit self-propelled cars equipped with disc brakes to improve shunting of track circuits, in collaboration with representatives of the A.A.R. Mechanical Division Committees on Locomotive Construction and Brakes and Brake Equipment and assisted by representatives of manufacturers of such cars and signal equipment.

Early reports of the performance of single unit rail Diesel cars of this type indicated the need for improved shunting of signal track circuits to avoid improper operation of automatic block signals, highway grade crossing protection and detector locking at interlockings, particularly at the higher operating speeds. The problem involves the weight of the single cars with only four axles forming parallel shunting circuits between the rails, and also the high shunting resistance between the rail and the wheel tread.

The former objection to the use of disc brakes because the wheels might not always be as bright and clean as when clasp type brakes are used, especially when there is frost, snow or moisture on the rails and sand is picked up on the tread of the wheels, has largely been overcome. Tests made on some of the railroads indicated that even if these lightweight cars were equipped with clasp brakes they might, under certain conditions, be subject to track circuit shunting difficulty while running between brake applications. Experience reported by these roads has indicated that where disc brakes are used improved shunting can be obtained when a properly designed wheel tread conditioning shoe is applied to the tread of each wheel. This requires that a program of controlling the condition, alignment and pressure of the shoes be set up and strictly followed.

In signal territories where single cars of this type are being operated it is necessary that the shunting sensitivity of the track circuits be increased. Committee IV is reviewing the shunting sensitivity tests which the Committee made on the Pennsylvania R.R. at White Valley, Pa., on October 18 and 25, 1937 in an effort to improve shunting by lightweight equipment.* The results of this study will be presented in a separate report.

The following information concerns the type of rail Diesel car now in use. This car is a full-sized, 85-foot car, of stainless steel construction having two four-wheel trucks which are spaced 59 feet 6 inches center to center. The car is equipped with 33-inch diameter wheels having standard tapered wheel tread. The disc of the disc brake is bolted to the inner face of each wheel. The car weight is 113,000 pounds ready-to-run and 128,000 pounds loaded. The car is propelled by two under floor mounted 275 horsepower General Motors Diesel power plants each driving the inboard axle of one truck through an integral torque converter and through a splined propeller shaft and universal joints to a gear box on the axle. Single-car top speed on level tangent track is 83 miles per hour. The car meets all A.A.R. strength specifications for main line equipment for unrestricted service. It is fully reversible, with controls at each end.

* A.A.R. Signal Section 1937 Proceedings, Vol. XXXV, pp. 46 and 205.

The RDC-1 seats 90 passengers (36-inch spacing) in two compartments divided by a partition which houses ducts leading between the roof and the underfloor. The RDC-2 contains a 17 ft. 1 in. baggage section, and seats 71 passengers. The RDC-3 contains a 15 ft. 1 in. Railway Post Office compartment, 16 ft. 9 in. baggage section, and seats 49 passengers.

To increase rail adhesion the car is equipped with both automatic and manual sanding devices. The Rolokron anti-wheel-slide device functions under heavy braking and adverse rail adhesion to automatically set off a 6-second sanding cycle on the lead wheels of each truck. Automatic sanding on a 30-second cycle becomes effective whenever emergency braking is applied. Although this sanding equipment is considered necessary to facilitate stopping a car in emergency, some concern has been expressed regarding the possibility of poor shunting in case of an automatic sanding cycle occurring when the car is about to stop, such that it would come to rest on a layer of sand. This situation might be avoided if the operating instructions of each railroad can successfully educate the engineman in safe sanding techniques and provide that the car be moved off the sand after the stop.

Every RDC car now being delivered is equipped with a standard wheel tread conditioning shoe installation on each wheel of the car consisting of a grooved cast shunt shoe of copper alloy continually bearing on top of the wheel tread. The shoe is held against the wheel by a steel torsion bar spring extending in a horizontal plane from the truck center transom. A screw adjustment at the transom permits varying shoe pressures on the wheel from zero to about 50 pounds. Based on past experience the pressure is being set at 25 pounds, plus or minus 5 pounds, for all new cars leaving the factory. Pressures below 15 pounds are less satisfactory because of lower effectiveness in conditioning the wheel tread. Pressures very much over 30 pounds lead to excessive shoe wear and increase maintenance costs without a commensurate increase of shunting performance.

Copper, bronze and cast-iron shoes have been tried in railroad service and the manufacturer has tested many non-ferrous alloys. The present standard shoes being furnished on the basis of tests are cast beryllium copper. The manufacturer claims the copper alloy shoe produces a thin metallic coating on the wheel tread which better conditions the wheel for electrical contact with the rail.

The manufacturer is electrically bonding each shoe to the truck frame and each truck frame is electrically bonded to the car body center sill to provide low resistance parallel electrical shunting circuits from any wheel on one rail to any wheel on the other rail.

At least one railroad has found on test that the bonds between the shoes and the truck frames contributed little or nothing to the effectiveness of shunt and in view of the difficulty in maintaining these bonds it was decided to eliminate them on that road. Some of the railroads are continuing to use copper or cast-iron shoes successfully.

The need for regular inspection of the shoes for wear, alignment and pressure cannot be stressed too emphatically as shoe operation is not in accordance with closed circuit principles and failure of the shoes may result in loss of shunt.

It has been found through experience that in order to operate the signal system in a satisfactory manner the following precautions must be taken:

1. Wheel tread conditioning shoes must be provided and be inspected care-

fully and frequently for wear, alignment and pressure. Record of inspection should be maintained.

2. Track circuits should be adjusted to provide good shunting sensitivity.
3. Track relays which are inherently slow in releasing should be replaced.
4. Stagger of insulated rail joints and dead sections should be reduced to a minimum, particularly within interlocking limits.
5. Protection against momentary loss of shunt should be provided in traffic locking circuits, interlocking approach circuits, highway crossing protection circuits, etc.
6. Special measures should be taken for operation on secondary track or branch line equipped with signal facilities where traffic density is light.
7. Enginemen should be instructed in braking and sanding methods to prevent the car coming to a stop on a layer of sand.

Action Recommended

Acceptance as information.

(Revision of A.A.R. Signal Section Specification 95-44)
A.A.R. SIGNAL SECTION SPECIFICATION 95-53.

SWITCH CIRCUIT CONTROLLER

1. *Purpose.*

(a) This specification is for the purpose of providing for a switch circuit controller for application to track switches, derails or other apparatus for the control of signal circuits. It sets forth specific detail requirements representing modern signal practice recommended for new installations and for replacement on existing installations when general renewal or replacement becomes desirable.

2. *Specifications and drawings.*

(a) Specifications and drawings referred to in the body of this specification form an essential part hereof.

(b) Manufacturer shall furnish with his tender, drawings forming an essential part thereof.

3. *Tender.*

(a) The tender shall be for a product meeting the requirements of this specification in its entirety.

4. *Purchaser's order requirements.*

(a) The following additional requirements will be shown on Purchaser's order:

1. Type of wire outlet.
2. Straight or offset crank with insulated or non-insulated ball stud, as required.
3. If offset crank is desired, offset dimensions shall be specified.
4. Radius of operating crank.
5. Two-position, three-position, or combination two and three-position type as required.
6. Inspection and tests as required.
7. Alternate requisites as required.

5. *Alternates.*

(a) The provisions contained in the alternate requisites section of this specification form a part hereof only when substituted by Purchaser's order for the provisions contained in this specification.

6. *Material and workmanship.*

(a) Material and workmanship shall be first-class in every respect.

7. General.

(a) Controllers shall be of two-position type, three-position type, or a combination of two-position and three-position types.

(b) Controllers shall have four front and four back dependent contacts. *R-7-b.

(c) Controller shall be equipped with suitable centering device. *R-7-c.

(d) All parts of mechanism shall be readily removable. Like parts of same design and manufacture shall be interchangeable.

8. Case.

(a) Case shall be of cast iron and of a design that provides for a separate compartment for binding posts and wire outlet.

(b) That portion of the case containing the operating cams and contacts shall have no opening below the main shaft bearings, except plugged hole for drainage purposes.

(c) That portion of the case containing binding posts shall have wire openings on both sides of the case, each having not less than 3 sq. in. open space for entrance of wires. One opening shall be provided with a suitable metal cover adaptable for use on either side of case. *R-8-c.

(d) A substantial wire outlet shall be provided in accordance with Purchaser's requirements and shall be interchangeable from one side to the other.

(e) Lugs shall be cast as part of case and shall have three holes cored for $\frac{3}{4}$ in. bolts for securing to tie. There shall be two lugs at one end with holes on 5 in. centers and one lug at the opposite end on center line of case.

(f) The over-all height of switch circuit controller case with cover closed shall not exceed 7 in.

9. Cover.

(a) Cover shall be of cast iron and provided with weather-proof gasket.

(b) Cover shall be provided with hinges so arranged that it may be removed from the case when unlocked. Suitable hasp shall be provided. Arrangement shall permit locking with a lock having a $\frac{3}{8}$ in. diameter shackle.

10. Ventilation.

(a) Ventilation for that part of the case containing contacts shall be provided by means of two hooded ventilators located on opposite sides of the box. Each ventilation opening shall be equipped with a corrosion-resistant screen, or equivalent, having openings totaling not less than $\frac{1}{4}$ sq. in. area.

* Alternate requisites section.

11. *Operating shaft.*

(a) Operating shaft shall be made of steel not less than $\frac{7}{8}$ in. diameter, and of required length to permit operating crank and clamp or shield to be applied on either end. Means shall be provided to prevent excessive end movement of shaft. Ends of shaft shall be not less than $\frac{3}{4}$ in. square.

(b) Bearings for operating shaft shall be removable. They shall be brass, phosphor bronze or other equally good bearing material. Means shall be provided for holding bearings securely in place. Bearings shall be not less than $1\frac{1}{4}$ in. long nor more than 0.003 in. larger inside diameter than outside diameter of journal.

(c) Bearings for operating shaft shall be provided with annular grease grooves and fittings for pressure lubrication.

12. *Operating crank.*

(a) Operating crank shall be of forged or cast steel, or of malleable iron, and designed to clamp on square section of operating shaft.

(b) Operating crank shall be of such length that at end of stroke $2\frac{3}{4}$ in. each direction from perpendicular center line of crank, the center of ball stud shall be not less than $1\frac{5}{16}$ in. nor more than 2 in. below the mounting surface of the case unless otherwise specified by Purchaser.

(c) Operating crank shall be provided with insulated or non-insulated ball stud, as specified by Purchaser, conforming to Drawing 1271 and equipped with pressure lubricating fitting. *R-12-c.

(d) Suitable clamp or shield shall be provided for opposite end of shaft.

(e) Means shall be provided to prevent crank and clamp or shield from being removed unless the clamping bolt is removed.

13. *Binding posts.*

(a) Binding posts, nuts and washers shall conform to Drawing 1070, assembly 107010. *R-13-a.

(b) Binding posts shall be mounted so they cannot be turned in the base or frame to which applied. They shall be properly insulated from each other and other metallic parts.

(c) Binding posts shall be spaced not less than 1 in. centers.

14. *Terminal board.*

(a) Terminal board shall be made of suitable material which shall not be injuriously affected by atmospheric conditions or by changes in temperatures between 40 deg. F. below zero and 185 deg. F. above zero, and shall be not less than $\frac{1}{2}$ in. thick.

(b) Terminals shall be so located as to be easily accessible.

* Alternate requisites section.

15. *Operating cams.*

(a) Operating cams shall be separately adjustable for each contact with provision made for locking in position when adjusted. *R-15-a.

(b) Cam shall force and hold mechanically the contacts in all positions. *R-15-b.

(c) Design of cam and operating crank shall be such that proper adjustment may be made for switches having a $3\frac{1}{2}$ in. to $5\frac{1}{2}$ in. throw. The operating crank shall not be required to travel through an angle of more than 90 deg. for complete operation.

(d) Cams shall be of such design that when operating crank is connected to switch points, the cams may be so adjusted that the contacts will be actuated in the following manner:

1. Contacts used for normally open circuits shall be actuated to close when the switch point is opened to $\frac{1}{4}$ in. and remain closed for the remainder of the switch point travel, and shall not open again until the operating crank has returned to the same position at which the contacts originally closed.

2. Contacts that are normally closed shall be actuated to open when the switch point is opened to $\frac{1}{4}$ in. and remain open for the remainder of the switch point travel and shall not close again until the operating crank has returned to the same position at which the contacts originally opened.

3. Contacts that are normally closed for three-position controllers shall be actuated to open when the switch point is opened to $\frac{1}{4}$ in. and remain open while the switch points are in transit and until the switch point is $\frac{1}{4}$ in. from full opposite position, when the opposite contacts shall close.

4. Contact movement shall not start until the switch point opening is at least $\frac{1}{16}$ in.

5. Complete contact operation shall take place in not over $\frac{3}{8}$ in. movement of the switch points.

(e) Design of cams shall be such that a two-position controller may be used as a three-position controller by using two cam spaces for each three-position circuit.

(f) Design of cams for three-position controller shall be such that each contact assembly may be used for a three-position circuit.

16. *Contacts.*

(a) Contacts shall be of suitable material and of substantial design. Contact elements shall be so secured that they will not shift nor become loose in service.

(b) Contact fingers shall be made of such material and so proportioned that they will maintain uniform contact pressure and meet contact surfaces squarely.

* Alternate requisites section.

16. *Contacts.*—Continued.

(c) Material used in affixing contact elements shall not cause corrosion.

(d) The movement of contact members shall be such as to insure a wiping contact of not less than $\frac{1}{32}$ in. and the contact pressure in closed position shall be not less than 3 lbs. 8 oz.

(e) Each current-carrying part shall be designed to carry 15 amperes continuously.

(f) Complete contact travel shall be not less than $\frac{1}{4}$ in. and the contact opening when opposite contact just closes shall be not less than $\frac{1}{16}$ in.

17. *Flexible connections.*

(a) Flexible connections where used shall be of sufficient strength, flexibility and current-carrying capacity to secure reliable and proper operation.

18. *Finish.*

(a) Metal parts, except where parts used are inherently resistant to corrosion, shall be protected against corrosion except where such protection will interfere with the proper functioning of that part. Zinc or cadmium shall not be used on current-carrying parts.

(b) Material used for protection against corrosion shall neither melt nor flake under atmospheric conditions between temperatures of 40 deg. F. below zero and 185 deg. F. above zero.

19. *Dielectric requirements.*

(a) Electrical apparatus assembled shall withstand for 1 minute an insulation test, at place of manufacture, of 3,000 volts a.c. between all parts of electric circuits and other metallic parts insulated therefrom.

(b) A surface leakage distance of not less than $\frac{1}{4}$ in. shall be provided between any exposed metallic part of the apparatus carrying current and any other metallic part thereof.

20. *Painting.*

(a) Case, cover and crank shall be painted on all sides in accordance with Specification 120, Manual Part 110.

21. *Inspection.*

(a) Purchaser may inspect the material or product at all stages of manufacture.

(b) Purchaser may inspect the completed product to determine that the requirements of this specification have been met.

(c) If product has not been accepted at point of production and if, upon arrival at destination, it does not meet the requirements of this specification, it may be rejected, and Manufacturer, upon request, shall advise Purchaser what disposition

21. Inspection.—Continued.

is to be made of the rejected product. Manufacturer shall pay all freight charges.

(d) If Purchaser is to make inspection at point of production it shall be so stated on Purchaser's order.

22. Tests.

(a) Tests may be made at point of production, or on samples submitted, and may also be made at destination.

(b) Manufacturer shall give Purchaser sufficient notice of time when the material or product will be ready for testing.

(c) Manufacturer shall provide, at point of production, apparatus and labor for making required tests under supervision of Purchaser.

(d) If tests are to be made at point of production, it shall be so stated on Purchaser's order.

23. Packing.

(a) Product shall be so assembled or packed as to permit convenient handling and to protect against loss or damage during shipment.

24. Marking.

(a) Purchaser's order, requisition and package number, name of Consignor, and name and address of Consignee, shall be plainly marked on outside of packages and on tags attached to loose pieces.

(b) Detail list of loose pieces, packages and their contents shall be furnished for each shipment.

25. Warranty.

(a) Manufacturer shall warrant the product covered by this specification to be free from defects in material and workmanship under ordinary use and service, his obligation under this warranty being limited to manufacturing, at point of production, any part or parts to replace those which shall be found defective within 1 year after shipment to Purchaser. This warranty shall not apply to any product which shall have been repaired or altered in any way by anyone other than Manufacturer thereof, so as to affect, in Manufacturer's judgment, its proper functioning or reliability, or which has been subjected to misuse, negligence or accident.

Alternate requisites.**R-7-b.**

Controllers shall have six front and six back dependent contacts.

R-7-c.

Controllers shall not be equipped with centering device.

Alternate requisites.—Continued.

R-8-c.

That portion of the case containing binding posts shall have wire opening in bottom of case having not less than 6 sq. in. open space for entrance of wires.

R-12-c.

1. Operating crank shall be provided with insulated or non-insulated ball stud, as specified by Purchaser and conforming to Purchaser's drawing.

2. Operating crank shall be provided without ball stud and with hole as specified by Purchaser.

R-13-a.

1. Binding posts, nuts and washers shall conform to Drawing 1070, assembly 107015.

2. Dimensions of nuts shall conform to Drawing 1070, details 107011 and 107012, except that dimension across the flats may be $\frac{1}{2}$ in. when so specified by Purchaser.

R-15-a.

Operating cams shall be separately adjustable for each set of contacts.

R-15-b.

Cam shall force and hold mechanically the contacts closed in one position. Operation of contacts in opposite position shall be by means of a spring.

Action Recommended

Acceptance for submission to letter ballot superseding subject-matter in the Manual.

Subject-matter to be Superseded

Specification 95-44—Universal Switch Circuit Controller, Manual Part 49.

(Revision of A. C. Track Circuit Characteristics)

A.C. TRACK CIRCUIT CHARACTERISTICS

1953

*Proposed Revision**A.C. Track Circuit Data Sheet for Railroad Records*

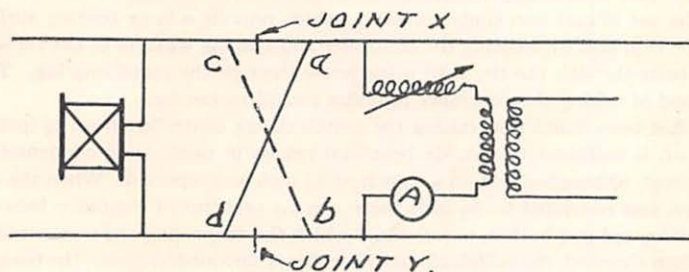
5. *Observed data for determining ballast resistance and rail impedance.*

(e) Volts across rails 0.4 the length of the track circuit from the feed end of the track circuit with relay disconnected.....

*Precautions to be Observed in Taking Readings in the Field
for Rail Impedance and Ballast Resistance*

1. Insulated joints shall be tested to determine that there is no leakage through them. This can be most easily done by connecting the track circuit as illustrated in the following sketch. No major change in ammeter deflection indicates little or no leakage. A large increase in current as indicated by the ammeter with connection applied

a to d indicates broken down joint at Y
b to c indicates broken down joint at X



3. The sets of readings, first with relay disconnected and second with track short circuited, should be taken, if possible, without an intervening train movement through the track circuit which might change conditions of bonding, insulated joints or ballast leakage.

*Formula for Calculating Rail Impedance and Ballast
Resistance for A.C. Track Circuits*

Observed readings:

$E_{0.4}$ = volts across rails 0.4 length of track circuit from feed end,
track relay open circuited.

*Data to be Furnished by Signal Engineers to Manufacturers
Relative to Track Circuit Requirements*

5. *Factors concerning the total impedance of track circuit.*
 - (s) Is broken-rail detection desired?
 - (t) Is broken-down insulated joint detection desired?

Action recommended

Acceptance for submission to letter ballot superseding subject-matter
in the Manual.

Subject-matter to be Superseded

Similarly identified sections in A.C. Track Circuit Characteristics,
Manual Part 161, pages 5, 6 and 11.

EFFECTIVENESS IN MINIMIZING CONDENSATION AND FROST IN SWITCH CIRCUIT CONTROLLERS BY RAISING THE CONTROLLER BOX OFF THE TIE

Inquiries directed to four railroads known to have experimented with elevating switch circuit controllers off the ties, indicates all four roads reduced condensation and frost formation by this method but this practice has not been widely expanded for the reason that the problem has been largely overcome by other preventive measures.

The most satisfactory results in elevating the controller have been obtained by the use of cast-iron timber washers, which provide a large bearing surface on the ties, and by securing the controller and spacing washers to the tie with two bolts through the tie, with a lag screw through the remaining lug. This method of raising the controller provides a rigid mounting.

It has been found that raising the switch circuit controllers from $\frac{1}{4}$ inch to $\frac{3}{8}$ inch is sufficient to provide beneficial results in minimizing condensation and frost, although elevation as much as $\frac{3}{4}$ inch was reported. When the elevation was restricted to $\frac{3}{8}$ inch there was no problem of clearance between operating rod and bottom of rail under which the connecting rod was installed.

When elevated, the switch circuit controller is surrounded by air, the temperature of the controller is more uniform, and the temperature of the case and its parts change more quickly with temperature changes of the surrounding air. This results in less difference between air temperature surrounding the case and the temperature of the parts of the switch circuit controller. This reduces the tendency for moisture to condense within the case and to form frost.

Additional benefits can be secured by improving ventilators, cleaning ventilator screens, prevention of warm moisture laden earth air currents from entering the circuit controller case via parkway outlets and conduits, auxiliary shields, heat, use of semaphore oil or antifreeze compounds on contacts, etc.

Proper ventilation and sealing off warm air paths are important whether or not the circuit controllers are elevated off the tie in preventing condensation and consequent frost. Where condensation is experienced other methods are equally important in the prevention of frost formation on contacts.

Action Recommended

Acceptance as information.

(Revision of A.A.R. Signal Section Specification 84-44)
A.A.R. SIGNAL SECTION SPECIFICATION 84-53.

TRANSFORMER, OIL-IMMERSED, SELF-COOLED*

1. *Purpose.*

(a) This specification is for the purpose of providing for an oil-immersed, self-cooled, single-phase transformer with maximum ratings of 15 kv. and 25 kv-a. It sets forth specific detail requirements representing modern signal practice recommended for new installations and for replacement on existing installations when general renewal or replacement becomes desirable.

2. *Specifications and standards.*

(a) Specifications and standards referred to in the body of this specification form an essential part hereof.

(b) Manufacturer shall furnish with his tender, drawings forming an essential part thereof.

3. *Tender.*

(a) The tender shall be for a product meeting the requirements of this specification in its entirety.

4. *Purchaser's order requirements.*

(a) The following additional requirements will be shown on Purchaser's order:

1. Frequency.
2. Primary voltage.
3. Kv-a. rating.
4. Primary voltage taps, if required, specify number of taps and rating of each.
5. Secondary voltages and power factor of each secondary.
6. Secondary voltage taps, if required, specify number of taps and rating of each.
7. Pole or platform mounting.
8. Service conditions if outside the limits shown in section 7-a.
9. Inspection and tests as required.
10. Alternate requisites as required.

5. *Alternates.*

(a) The provisions contained in the alternate requisites section of this specification form a part hereof only when substituted by Purchaser's order for the provisions contained in this specification.

* The term "oil" used throughout this specification includes non-inflammable synthetic liquids as well as mineral transformer oil.

6. *Material and workmanship.*

(a) Material and workmanship shall be first-class in every respect.

7. *Service conditions.*

(a) Equipment furnished in accordance with this specification shall be suitable for operation at its rating provided that:

1. The ambient temperature does not exceed 104 deg. F. and the average ambient temperature for any 24-hour period does not exceed 86 deg. F.

2. The altitude does not exceed 3,300 ft.

8. *Type.*

(a) Transformer shall be of the two bushing type designed for outdoor service.

(b) Transformer shall be designed for either platform or pole mounting as specified by Purchaser.

9. *Windings.*

(a) Voltages, primary taps and kv-a. capacities, unless otherwise specified, shall be in accordance with Preferred Ratings of Single-Phase Transformers 500 Kv-a. and Smaller, given in current American Standard for Distribution, Power and Regulating Transformers, C57.12.

10. *Ratio tolerance.*

(a) With rated voltage impressed on one winding of the transformer, all other rated voltages at no load shall be correct within one-half of 1 per cent of the name plate markings.

(b) Rated tap voltages shall be the voltages obtained by the nearest turn to the calculated number of turns, if the voltage per turn exceeds one-half of 1 per cent of the desired tap voltage.

11. *Losses.*

(a) The losses shall not exceed guaranteed values by more than 10 per cent for no-load losses or 6 per cent for total losses.

12. *Regulation.*

(a) Transformer regulation, computed from impedance volts and impedance watts measured by watt-meter, may exceed the specified regulation at specified power factors by not more than 7.5 per cent for two-winding transformers, or 10 per cent for transformers with three or more windings.

13. *Rating.*

(a) Transformer shall have a continuous kv-a. rating equal to the sum of the ratings of all the secondaries.

14. *Frequency.*

(a) Transformer shall be designed for the frequency specified by Purchaser.

15. *Tank.*

(a) Transformer tank and cover shall be made of steel or cast iron. Tank shall be free from leaks and shall be impervious to oil. Cover shall be provided with suitable gaskets.

(b) Finish for transformer tank and cover shall be pigment paint or enamel.

(c) Unless otherwise specified, accessories shall be in accordance with Standard Accessories for Single-Phase Transformers 500 Kv-a. and Below, given in current American Standard for Distribution, Power and Regulating Transformers, C57.12.

16. *Core.*

(a) Transformer core shall be constructed of oriented-grain silicon steel. *R-16-a.

(b) Audible sound level shall be in accordance with NEMA Standards for Transformers 48-132 or latest revision thereof.

17. *Insulation.*

(a) Material used for insulation shall be such that in the completed device it will not be injuriously affected by atmospheric conditions or immersion in oil.

(b) Windings shall be insulated to meet Standard Dielectric Tests for Transformers, Regulators and Reactors, given in current American Standard General Requirements for Transformers, Regulators and Reactors, C57.11.

18. *Temperature rise.*

(a) Temperature rise shall be in accordance with Limits of Temperature Rise, given in current American Standard General Requirements for Transformers, Regulators and Reactors, C57.11.

19. *Operation above rated voltage.*

(a) Transformer shall be capable of delivering rated output in kv-a. at 5 per cent above rated output voltage and operating at 10 per cent above rated output voltage at no load, without exceeding the specified temperature rise. Unless otherwise specified, this applies to load power factors of 80 per cent or higher.

20. *Polarity and terminal markings.*

(a) Polarity and terminal markings, unless otherwise specified, shall be in accordance with NEMA Standards for Transformers 48-132 or latest revision thereof.

21. *Bushings.*

(a) Details of bushings and bushing arrangements shall be in accordance with NEMA Standards for Transformers 48-132 or latest revision thereof. *R-21-a.

* Alternate requisites section.

22. *Name plate and diagram.*

(a) A name plate shall be securely fastened to each transformer and shall give the following information:

1. Name and address of Manufacturer.
2. Total kv-a. rating.
3. Frequency.
4. Primary voltage.**
5. Total voltage of each secondary winding.
6. Serial number.
7. Manufacturer's reference number.

(b) Information showing the ampere capacity of each secondary, the full-load voltage and tap voltages of each winding and the relative instantaneous polarities of the leads shall be shown on a diagram attached to each transformer, or, where practicable, this information may be marked on the terminal board or name plate.

23. *Oil.*

(a) Oil shall be in accordance with Specification 46, Manual Part 108.

(b) Non-inflammable synthetic liquid shall be an insulating liquid which, when decomposed by the electric arc, evolves only non-explosive gaseous mixtures.

(c) Sufficient oil shall be furnished to fill the transformer to the oil level mark, completely immersing the core, windings, high-voltage terminal boards and terminals, and to adequately dissipate the heat generated by the losses.

24. *Inspection.*

(a) Purchaser may inspect the material or product at all stages of manufacture.

(b) Purchaser may inspect the completed product to determine that the requirements of this specification have been met.

(c) If product has not been accepted at point of production and if, upon arrival at destination, it does not meet the requirements of this specification, it may be rejected, and Manufacturer, upon request, shall advise Purchaser what disposition is to be made of the rejected product. Manufacturer shall pay all freight charges.

(d) If Purchaser is to make inspection at point of production it shall be so stated on Purchaser's order.

25. *Tests.*

(a) Tests may be made at point of production, or on samples submitted, and may also be made at destination.

(b) Manufacturer shall give Purchaser sufficient notice of time when the material or product will be ready for testing.

** If high-voltage winding is suitable for Y operation, name plate shall be so marked.

25. *Tests.*—Continued.

(c) Manufacturer shall provide, at point of production, apparatus and labor for making required tests under supervision of Purchaser.

(d) All transformers purchased under this specification shall receive the following tests:

1. No-load loss.
2. Exciting current at rated voltage.
3. Polarity check.
4. Ratio check.
5. Dielectric tests.
 - (a) Applied-potential test.
 - (b) Induced-potential test.

(e) The following tests may be specified by Purchaser (charge may be made if any of these tests are required):

1. Impulse test.
2. Load loss or impedance test.
3. Temperature test.
4. Inspector's test.

(f) Tests shall be made in accordance with current American Standard Test Code for Distribution, Power and Regulating Transformers, C57.22.

(g) If tests are to be made at point of production, it shall be so stated on Purchaser's order. Purchaser shall indicate which of the tests herein specified are to be made and what portion of the material or product shall be tested.

26. *Packing.*

(a) Product shall be so assembled or packed as to permit convenient handling and to protect against loss or damage during shipment.

27. *Marking.*

(a) Purchaser's order, requisition and package number, name of Consignor, and name and address of Consignee, shall be plainly marked on outside of packages and on tags attached to loose pieces.

(b) Detail list of loose pieces, packages and their contents shall be furnished for each shipment.

28. *Warranty.*

(a) Manufacturer shall warrant the product covered by this specification to be free from defects in material and workmanship under ordinary use and service, his obligation under this warranty being limited to manufacturing, at point of production, any part or parts to replace those which shall be found defective within 1 year after shipment to Purchaser. This warranty shall

28. *Warranty*.—Continued.

not apply to any product which shall have been repaired or altered in any way by anyone other than Manufacturer thereof, so as to affect, in Manufacturer's judgment, its proper functioning or reliability, or which has been subjected to misuse, negligence or accident.

Alternate requisites.

R-16-a.

Transformer core shall be constructed of non-aging laminated silicon steel.

R-21-a.

Bushings shall be of the one-piece porcelain type, securely cemented into position in the case with a high-grade oil-proof bushing cement.

Action Recommended

Acceptance for submission to letter ballot superseding subject-matter in the Manual.

Subject-matter to be Superseded

Specification 84-44—Transformer, Oil Immersed, Self-Cooled, Manual Part 165.

USE OF HIGH-VOLTAGE LIGHTNING ARRESTERS—
VARIOUS VOLTAGE RANGES

In the application of lightning arresters, the following two relationships are fundamental and must be evaluated:

1. The impulse voltage protective characteristics of the lightning arrester in relation to the permissible impulse voltage test level of the apparatus to be protected.
2. The voltage rating of the lightning arrester in relation to the maximum system voltage which can occur from line to ground at the lightning arrester location under any conditions of operation.

The impulse voltage protective level which can be obtained with a given type of arrester is, in general, proportional to the voltage rating of the arrester. Therefore, to obtain the maximum margin of protection under impulse conditions, the lightning arrester should have the lowest voltage rating consistent with the normal and abnormal line to ground voltage which may occur on the circuit at the location where the arrester is to be used.

The choice of the distribution-type lightning arrester for any specific distribution system is ordinarily made upon the basis of experience. When selecting arresters for a particular application, consideration should be given to the manufacturer's ratings with respect to altitude and ambient tempera-

ture. However, the following table indicates the industry practice in general on three-phase systems for arrester ratings of 15,000 volts and below:

Arrester voltage rating (maximum permissible line to ground)	Limits of normal system operating voltage (phase to phase)			
	Solidly grounded neutral systems		Ungrounded neutral systems	
	Minimum	Maximum	Minimum	Maximum
175		175		175
650		650		650
1,000	300	1,000	300	1,000
3,000*	1,001	4,500	1,001	3,000
6,000*	4,501	9,000	3,001	6,000
9,000*	9,001	12,800	6,001	9,000
12,000	12,801	15,000	9,001	12,000
15,000	15,001	18,000	12,001	15,000

For single-phase systems, the same line to ground voltage rating as on three-phase systems is used depending upon the neutral grounding connection. In the case of a solidly grounded neutral circuit two arresters are used at a single-phase installation between each phase wire and ground. If the neutral conductor is grounded at the source and brought out along the line and the single-phase circuit consists of the phase wire conductor and neutral, one arrester is used between the phase wire and ground. The neutral conductor should be solidly grounded at each arrester location or alternatively grounded through suitable neutral gaps.

Action Recommended

Acceptance as information.

* Because of more stringent requirements which arise in the protection of rotating machines, additional arrester ratings of 4,500 and 7,500 volts are available for this application. Suitable protective capacitors may also be required in addition to arresters, for alternating current rotating machines.

A.A.R. SIGNAL SECTION REQUISITES.

DISCHARGE RESISTORS

1953

1. These requisites are for the purpose of setting forth the recommended general requirements for discharge resistors. They set forth specific detail requirements representing modern signal practice recommended for new installations and for replacement of existing installations when general renewal or replacement becomes desirable.

2. Discharge resistors shall be suitable for interconnection of primary lightning arrester and signal lightning arrester grounds to track rails at signal apparatus locations.

3. Discharge resistors shall have inverse resistance-current characteristics, so that negligible current will flow at normal voltage; but will, without time lag or sparkover, pass large amounts of lightning discharge current.

4. Discharge resistor shall be a two-pole device in order to provide a means of electrically connecting the primary arrester and signal arrester grounds to each track rail. A midpoint terminal shall be provided for connection to the lightning arrester ground bus.

5. The inverse resistance-current characteristic of each pole of the discharge resistor shall be the same in order to distribute the lightning discharge currents equally in both rails and to reduce the voltage stress across apparatus connected to the rails.

6. Discharge resistor shall have the discharge capacity and thermal endurance necessary to withstand the sum of the currents occurring when several secondary signal arresters and primary arresters discharge their combined lightning and power-follow currents to track rails.

7. Discharge resistor shall be capable of withstanding repeated operations without changing its characteristics. It shall be treated so as not to be injuriously affected by atmospheric conditions or by changes in temperatures between 40 deg. F. below zero and 185 deg. F. above zero.

8. Discharge resistors shall be designed for indoor service and shall be suitable for mounting inside of relay cases and housings.

9. Binding posts, nuts and washers shall conform to Drawing 1070, detail 107010. Binding posts shall be properly insulated from each other and other metallic parts.

10. For application on non-electrified roads, each pole of discharge resistor shall have a maximum continuous rating of 130 volts, d.c. or a.c. (r.m.s.). For application on electrified roads, each pole of discharge resistor shall have a maximum continuous rating of 220 volts, d.c. or a.c. (r.m.s.).

Action Recommended

Acceptance for submission to letter ballot.

COMMITTEE V—CONTRACTS AND INSTRUCTIONS

Personnel

E. B. Platt, Chairman

F. Youngwerth, Vice-Chairman

W. Abell	A. T. Hunot
G. D. Booth	J. G. Karlet
L. C. Brown	F. M. Kunker
W. N. Donahue	C. L. Ott
R. C. Dueland	J. A. Phillips
A. C. Eastman	E. L. Rogers
E. W. Hastings	G. C. Schindler
I. D. Hesler	W. L. Scott

S. P. Searle

Signal Section, A.A.R.:

The following outline of work has been assigned:

1. Revision of Manual.
2. Indexing signal literature.
3. Instructions for testing signal installations before placing in service.
4. Forms for reporting progress of the component parts of new signal installations and expenditures for labor.
5. Investigate and report on the use of portable induction type telephones by signal forces.
6. Specification covering an instrument for determining ground resistance.
7. Recommend uniform practice in reporting track circuit rail bond failures under I.C.C. classifications, collaborating with Committees I and IV.

The Committee submits for consideration, reports on the following subjects*:

1. Revision of Instructions for Storage Batteries, Manual Part 14.
Revision of Instructions for Spring Switches, Manual Part 140.
Revision of Instructions for Automatic Highway Grade Crossing Protective Systems, Manual Part 150.
Revision of General Classification for Signal Failures and Signal Interruptions, Manual Part 52.
Guide for determining performance and efficiency of signal systems.
5. Use of portable type telephones by signal forces.
6. Specification 261-53.
Cooperative report. American Standards Association—Graphical Symbols and Designations—Project Y32.
Cooperative report. American Standards Association—Definitions of Electrical Terms—Project C42—Subgroup 8.

* Suggestions or criticisms should be submitted in writing to the Chairman of the Committee on or before August 28, 1953.

Information

Specifications, etc., of other organizations referred to in the report of this Committee may be procured from the following:

A.S.A.—American Standards Association, 70 E. 45 St., New York 17, N. Y.

Disposition of 1952 Letter Ballot Subjects

The following subjects presented by Committee V at the 1952 Annual Meeting were submitted to letter ballot and officially approved:

Definitions for Technical Terms Used in Signaling—Now in Manual Part 55.
Specification 112-52—Portable Alternating Current Ammeter—Now in Manual Part 3.

Instructions for Made Grounds—Now in Manual Part 61.

Specification 85-52—Portable Direct Current Voltmeters, Ammeters and Volt-Ammeters—Now in Manual Part 168.

Specification 115-52—Portable Alternating Current Voltmeter—Now in Manual Part 169.

Instructions for Electric Switch Locks—Now in Manual Part 162.

Instructions for Track Circuits—Now in Manual Part 8.

Instructions for Copper-Oxide Caustic Soda Primary Cells—Now in Manual Part 7.

Instructions for Car Retarder Systems—Now in Manual Part 125.

Instructions for Insulation Resistance—Now in Manual Part 130.

Instructions for Facing Point Locks Applied to Spring Switches—Now in Manual Part 159.

(Revision of Instructions for Storage Batteries)
A.A.R. SIGNAL SECTION INSTRUCTIONS.

STORAGE BATTERIES*

1953

These instructions apply to the installation, maintenance and test of storage batteries. They set forth general requirements representing recommended practice.

1. Maintenance, test and repair work which may interfere with safe operation of trains must not be started until train movements have been fully protected. Temporary repairs or adjustments, when required, must be made in such manner that safety of train operation will not be impaired. When repair, adjustment, change or replacement is made, tests must be made immediately to determine that the apparatus functions as intended. When making tests of apparatus, proper instruments must be used and it must be known that no unsafe conditions are set up by the application of testing equipment.

2. To reduce danger from explosion or fire, an open flame must not be permitted near battery. Extreme care must be exercised to avoid a spark or flash when changing connections or working on or near a battery. Battery load must first be disconnected at a point remote from the battery.

3. Care must be exercised to avoid external short circuiting.

4. Electrolyte must be handled carefully as it is injurious to person, clothing and other foreign matter.

5. If solution or electrolyte is accidentally spilled on skin or clothing it immediately should be washed away with plenty of water.

6. Battery must be arranged to permit access for cleaning and inspection.

7. Contact surfaces of connectors, jumper lugs and cell posts must be clean and kept tight. Cell posts and connecting bolts should be coated as instructed.

8. Ventilation of battery housing, when provided, must be such as to prevent entrance of snow, water, dirt, etc.

9. Direct current must be supplied at battery terminals for charging purposes.

10. Charging wires to battery must be connected with the positive wire of the charging circuit connected to the positive terminal. Polarity of charging circuit must be determined by meter test.

11. Batteries must not be continuously over or undercharged.

12. Excessive gassing must be avoided.

13. If battery has been completely discharged it must be charged immediately.

14. Water used in battery must be either distilled or from a source which has been tested and approved for storage battery use. Water must only be kept in approved containers.

* The term "as instructed" as used herein refers to individual railroad instructions.

15. Add water to cells often enough to maintain electrolyte levels at approximately recommended height. When water is added in cold weather, agitate the electrolyte with hydrometer syringe to mix the water with the electrolyte to prevent the water from freezing.

16. Metals must not be used to stir electrolyte.

17. Electrolyte recommended by manufacturer must be used. Special solutions, powders, jellies, or other additives must not be used.

18. Cells showing irregularities, which cannot be corrected, must be taken out of service and report made to proper authority.

19. Defective containers must be removed from service.

20. Approved hydrometers and thermometers must be used.

21. Hydrometers, thermometers or other utensils used for one type of electrolyte must not be used for any other type.

22. Meters must be in accordance with Specification 85, Manual Part 168, and must be checked frequently and calibrated when necessary.

23. Results of inspections and tests herein required and all other inspections and tests that may be required must be recorded as instructed.

Nickel, Iron, Alkaline Type

24. The range of specific gravity of electrolyte at correct solution height, as recommended by manufacturer, with battery fully charged must be maintained in accordance with the following table:

Temperature of electrolyte, degrees Fahrenheit	Maximum recommended gravity (solution at recommended level)		Minimum recommended gravity, all type cells
	Standard, or low, type cells	High type cells	
110	1.217	1.202	1.147
100	1.220	1.205	1.150
90	1.222	1.207	1.152
80	1.225	1.210	1.155
70	1.227	1.212	1.157
60	1.230	1.215	1.160
50	1.232	1.217	1.162
40	1.235	1.220	1.165
30	1.237	1.222	1.167
20	1.240	1.225	1.170
10	1.242	1.227	1.172
0	1.245	1.230	1.175

Corrections in specific gravity not covered by this table for temperature and electrolyte height should be made as follows: for temperature, the correction is 0.0025 added to the specific gravity at 60 degrees Fahrenheit for every 10 degrees below 60 degrees Fahrenheit, and subtracted for every 10 degrees above 60 degrees Fahrenheit. For variations in height, 0.005 should be added for each $\frac{1}{4}$ inch above normal height and subtracted for each $\frac{1}{4}$ inch below.

25. When the specific gravity has reached approximately the minimum recommended gravity at correct solution height the electrolyte should be renewed in accordance with manufacturer's instructions.

26. The specific gravity of electrolyte does not indicate the state of charge. Occasional readings should be taken, as instructed, to determine the condition of the electrolyte.

27. Cells taken out of service for a period of 2 months or more must be discharged at the normal rate to 0.5 volt per cell and then short circuited in groups of not more than five series connected cells. They must be stored in a dry place and care exercised to see that electrolyte does not fall below the top of the plates.

28. Before restoring a cell to service, that has been stored in a completely discharged condition, the electrolyte must be raised to the correct level. The cell must then be given a charge equivalent to a charge at the normal 7-hour charging rate for 15 hours.

Lead Acid Type

29. Specific gravity readings must be taken with electrolyte at correct height and corrections made for temperature as follows:

(a) To correct to normal temperature 77 degrees Fahrenheit, subtract one point (0.001 specific gravity) for each 3 degrees below 77 degrees Fahrenheit and add one point for each 3 degrees above 77 degrees Fahrenheit.

Example:

107 degrees Fahrenheit, add 10 points
92 degrees Fahrenheit, add 5 points
77 degrees Fahrenheit, no correction
62 degrees Fahrenheit, subtract 5 points
47 degrees Fahrenheit, subtract 10 points

30. Elements must not be exposed to the air.

31. Battery temporarily stored must be put in a dry clean location where temperature is above freezing and, if practicable, below 90 degrees Fahrenheit.

32. Battery not placed in service within a reasonable length of time must be given a charge and if specific gravity drops below 1.180 recharge battery as instructed.

33. Electrolyte lost due to spillage must be replaced with the proper amount of electrolyte of the same specific gravity as that of other cells of the battery. In emergency where level is below top of plates add water as a temporary measure to prevent the plates from becoming dry.

34. All cells to be placed in service must be tested to determine that the specific gravity is 1.180 or above. If any cells are found to be below 1.180 they must be given a complete charge.

35. When mixing sulphuric acid with water, pour acid slowly into water, thoroughly stirring with glass or hard rubber paddle. Water must not be poured into acid.

36. Fresh mixed electrolyte must not be placed in cells until it has cooled.

Action Recommended

Acceptance for submission to letter ballot superseding subject-matter in the Manual.

Subject-matter to be Superseded

Instructions for Storage Batteries, Manual Part 14.

(Revision of Instructions for Spring Switches)
A.A.R. SIGNAL SECTION INSTRUCTIONS.

SPRING SWITCHES*

1953

These instructions apply to the installation, maintenance, and test of spring switches. They set forth general requirements representing recommended practice.

1. Maintenance, tests and repair work which may interfere with safe operation of trains must not be started until train movements have been fully protected. Temporary repairs or adjustments, when required, must be made in such manner that safety of train operation will not be impaired. When repair, adjustment, change or replacement is made, tests must be made immediately to determine that the apparatus functions as intended. When making tests of apparatus, proper instruments must be used and it must be known that no unsafe conditions are set up by the application of testing equipment.

2. Checks must be made to determine that:

- (a) Spring switch is in good condition.
- (b) Parts of switch and supports are properly secured.
- (c) Track is securely anchored and kept in proper gage, surface and alignment.
- (d) Proper drainage is provided.

3. When checks or tests develop that track conditions are such that they may cause unsatisfactory operation of spring switch, the section foreman, or whoever is immediately responsible, must be requested to remedy the condition. If such request is not acted upon within a reasonable time, the matter must be reported to proper authority in writing.

4. The type and quality of buffing agent used in the buffer must be as recommended by the manufacturer or as instructed. Oil used as a buffing agent must be in accordance with Specification 230, Manual Part 236. The frequency with which the buffing agent should be changed, and the cleaning of the buffer and strainer must be as instructed. Buffing agent must be kept at proper level in the buffer. Where low temperatures are encountered and oil is used as a buffing agent, antifreeze treatment must be used as instructed.

5. Packing around piston rod must be kept tight to prevent leakage of buffing agent, care being exercised to see that the tightening does not interfere with free action of the switch. The exposed portion of the piston rod should be kept coated with grease.

6. Buffer and switch operating spring must be so adjusted and tests made as instructed, to determine that proper spring compression is developed and maintained so that switch points return to their proper position within the specified time limits and that the closed point is held against the rail with adequate force.

* The term "as instructed" as used herein refers to individual railroad instructions.

7. During snow and sleet storms switches must be kept clear of snow and ice. Where open flame snow-melting devices are used, care must be exercised to prevent damage to apparatus and devices kept clear of all moving parts.

8. Paint must be applied as often as required. Rusty surfaces must be cleaned before painting. Paint must not be applied to piston rods, threads of adjusting screws, padlocks or gaskets.

9. Threads of rods, jaws and bolts, and bearings of all movable parts must be kept clean and properly lubricated.

10. Bolts, nuts, pins and cotters of proper size and type must be kept in place, nuts kept tight and cotters properly spread.

11. Parts which fail to perform their intended functions must be properly adjusted, repaired, or replaced.

12. When making repairs or adjustments of spring switches and before removing rails, switch points or frogs, protecting signals must be secured to display their most restrictive aspects. Signals must not be restored to normal operation until tests have been made and it is known that they function as intended and that the track is safe for train operation.

13. Spring switches will be spiked and blocked only as instructed. Proper measures must be taken to protect train movements as instructed and proper authority notified when spring switch is spiked and blocked.

14. When spring switch is equipped with facing point lock, it must be maintained and tested in accordance with Instructions for Facing Point Locks Applied to Spring Switches, Manual Part 159.

15. When spring switch is equipped with circuit controller, it must be maintained and tested in accordance with Instructions for Switch Circuit Controllers, Manual Part 134.

16. Spring switch buffers and any other parts removed from service for repairs must be returned with full information as required on repair tag Form 7018, Manual Part 124, or as instructed.

17. Results of inspections and tests herein required and all other inspections and tests that may be required must be recorded as instructed.

Action Recommended

Acceptance for submission to letter ballot superseding subject-matter in the Manual.

Subject-matter to be Superseded

Instructions for Spring Switches, Manual Part 140.

(Revision of Instructions for Automatic Highway Grade Crossing Protective Systems)
A.A.R. SIGNAL SECTION INSTRUCTIONS.

AUTOMATIC HIGHWAY GRADE CROSSING PROTECTIVE SYSTEMS*

1953

These instructions apply to the installation, maintenance and test of automatic highway grade crossing protective systems. They set forth general requirements representing recommended practice.

1. Maintenance, tests and repair work which may interfere with safe operation of trains must not be started until train movements have been fully protected. Temporary repairs or adjustments, when required, must be made in such manner that safety of train operation will not be impaired. When repair, adjustment, change or replacement is made, tests must be made immediately to determine that the apparatus functions as intended. When making tests of apparatus, proper instruments must be used and it must be known that no unsafe conditions are set up by the application of testing equipment.

2. Proper precautions must be taken to protect highway traffic before changes or tests are made which would affect operation of highway crossing protective systems.

3. Protective devices must be kept in good condition and maintained as instructed. Signs, reflectors and roundels must be kept clean and intact. Operating mechanisms must be kept free from dirt and excessive grease and lost motion. All bearings must be properly lubricated. Contacts must be kept clean and in proper adjustment.

4. Protective devices must be installed and maintained so as to conform to established clearances as instructed.

5. Performance of protective devices must be checked periodically and recorded on Form 7054, Manual Part 150, or as instructed.

6. Signals must be checked, as instructed, from each highway approach to insure that they are properly aligned and that view of signal is not obstructed.

7. In case of severe storm, inspection must be made as soon as practicable, and trouble corrected as instructed.

8. Tests must be made periodically, as instructed, to determine that the various safety features are effective.

9. Each circuit which would affect the operation of highway grade crossing protective system, the functioning of which affects the safety of train operation, except circuit which includes any track rail must be kept free of any ground or combination of grounds as instructed. In no case shall a flow of current be permitted which is equal to or in excess of 75 per cent of the release value of any relay or other electromagnetic device in the circuit.

10. Each wire must be tagged or otherwise marked so it can be identified at each terminal. Nomenclature must correspond to that of the circuit plan.

* The term "as instructed" as used herein refers to individual railroad instructions.

Tags or other marks of identification in instrument cases and apparatus housings must be made of insulating material. Wires, tags, or other markings must not interfere with moving parts of apparatus.

11. Lightning arresters and made grounds must be properly connected, maintained and tested as instructed.

12. Housings must be kept clean and must not be used for storing material, tools or supplies unless special provision is made. They should not be opened in severe or stormy weather, except when conditions require.

13. Doors, covers, and fastenings must be kept in good condition with suitable gaskets in place.

14. Paint must be applied as often as required. Rusty surfaces must be cleaned before painting. Paint must not be applied to padlocks or gaskets.

15. Reflector signs must be maintained in accordance with Instructions for Maintaining Reflector Signs, Manual Part 234.

16. Flashing light signal units, reflector type with sealed lamp receptacle must be focused and aligned in accordance with Instructions for Focusing and Aligning Railroad-Highway Grade Crossing Flashing Light Signal Units, Reflector Type, with Sealed Lamp Receptacle, Manual Part 268.

17. Electric lamps must be maintained and tested in accordance with Instructions for Incandescent Electric Lamps, Manual Part 120.

18. Switch circuit controllers must be maintained and tested in accordance with Instructions for Switch Circuit Controllers, Manual Part 134.

19. Cells and batteries must be maintained and tested in accordance with Instructions for Cells and Batteries, Manual Parts 7 and 14.

20. Track circuit must be maintained and tested in accordance with Instructions for Track Circuits, Manual Part 8.

21. Wire and cable must be maintained and handled in accordance with Instructions for Wire and Cable, Manual Part 190.

22. Relays must be maintained and tested in accordance with Instructions for Relays, Manual Parts 124 and 126.

23. Rectifiers must be maintained and tested in accordance with Instructions for Rectifiers and Motor-Generators, Manual Part 68.

24. Insulated rail joints must be maintained and tested in accordance with Instructions for Insulated Rail Joints, Manual Part 133.

25. Insulation resistance tests must be made in accordance with Instructions for Insulation Resistance, Manual Part 130.

26. Ground resistance must be maintained and tests made in accordance with Instructions for Made Grounds, Manual Part 61.

27. Results of inspections and tests herein required and all other inspections and tests that may be required must be recorded as instructed.

Action Recommended

Acceptance for submission to letter ballot superseding subject-matter in the Manual.

Subject-matter to be Superseded

Instructions for Automatic Highway Grade Crossing Protective Systems, Manual Part 150.

USE OF PORTABLE TYPE TELEPHONES BY SIGNAL FORCES

A previous report on the use of portable type telephones by signal forces was presented at the 1947 Annual Meeting*.

The following information was obtained from replies to questionnaire (Inquiry SS-98A) issued June 18, 1952 to Voting Representatives of Member Roads in the Signal Section, which was extended to cover all types of portable telephones used by signal forces. 99 replies were received.

Following is a summary of the various types of portable telephones in use:

Type	Roads reporting use
Induction.....	8
Carrier.....	20
Radio.....	4
Conventional line.....	76

Of the roads reporting use of the induction type, 7 roads reported this type used in daily routine maintenance and inspection and 5 roads reported its use for periodic inspection and test. Satisfactory communication was obtained up to 1 mile. Practicable applications have been made as follows:

To facilitate the operation of work trains.....	4
Establishment of emergency wayside stations.....	5
Providing protection in hazardous locations, such as tunnels.....	1
Use by track maintenance crews.....	6
Use by signal emergency crews.....	7

Of roads reporting use of carrier type, 8 roads reported this type used in daily routine maintenance and inspection and 17 roads reported its use for periodic inspection and test. Satisfactory communication was obtained up to 350 miles.

Practicable application has been made on 3 roads to establish emergency wayside stations; 1 road to provide protection in hazardous locations such as tunnels; 1 road for use of track maintenance crews; 8 roads for use of signal emergency crews. No railroads reported any other unusual occurrences where this type of equipment has been of particular value.

Answers to the inquiry as to the use of the radio-type phone indicated that none of the roads use this equipment for daily routine maintenance and inspection; 3 roads reported its use for periodic inspection and test. Satisfactory communication was obtained from 1 to 6 miles. No roads reported use of this equipment to facilitate the operation of work trains; 1 road reported its use for the establishment of an emergency wayside station; no roads reported its use in providing protection in hazardous locations; no use by track maintenance crews; 2 roads reported its use by signal emergency crews. No roads reported any unusual occurrences where this type of equipment has been of particular value.

Action Recommended

Acceptance as information.

* A.A.R. Signal Section 1946 Proceedings, Vol. XLIV, pp. 180-A and 372-A.

A.A.R. SIGNAL SECTION SPECIFICATION 261-53.
GROUND RESISTANCE TESTING INSTRUMENT
NULL-BALANCE TYPE1. *Purpose.*

(a) This specification is for the purpose of providing for a portable self-contained ground resistance testing instrument of the null-balance, battery-powered vibrator type.

2. *Tender.*

(a) The tender shall be for a product meeting the requirements of this specification in its entirety.

3. *Purchaser's order requirements.*

(a) The following additional requirements will be shown on Purchaser's order:

1. Class of instrument as specified in section 6.
2. Range of instrument as specified in section 8.
3. Fabric or leather carrying case when required.
4. Test leads when required.
5. Reference ground rods when required.
6. Inspection and tests as required.

4. *Material and workmanship.*

(a) Material and workmanship shall be first-class in every respect.

5. *Design.*

(a) Instrument shall be of a design acceptable to Purchaser.

(b) Instrument shall be completely self-contained, equipped with battery, vibrator and suitable circuits to supply necessary test potential or current for making ground resistance tests as follows:

1. Single-test, direct-reading method using two reference grounds.
2. Direct reference method using a single reference ground of low or known resistance.

(c) Means shall be provided so that the battery circuit shall remain open except when measurements are being made.

(d) Selecting switch shall be provided in all instruments having multiple ranges.

6. *Classes.*

(a) Instruments shall be of three general classes:

1. Class 1 for use where a relatively high degree of accuracy and wide range are desired.
2. Class 2 for use where a relatively high degree of accuracy and average range are desired.
3. Class 3 for use where instruments of lighter weight, smaller size, and less accuracy than Classes 1 and 2 are desired with lower over-all ranges which are also suitable for earth resistivity measurements.

7. Scales.

(a) Scales shall be shown on a calibrated potentiometer dial.

(b) Length of scales shall be measured on arc described by the potentiometer knob pointer.

(c) The length and divisions for the various classes shall be as follows:

Class	Minimum length of scale, in.	Minor divisions	Major divisions
1	3½	30	15
2	3½	0	12
3	3½	50	10

(d) Each major division of the scale shall be clearly emphasized.

8. Ranges.

(a) Ohmic ranges of instrument in each class shall be as follows:

Class	
1	0-3, 0-30, 0-300, 0-3,000
2	0-12.5, 0-125, 0-1,250
3	0-1, 0-10, 0-100, 0-1,000

9. Binding posts.

(a) Connections to instrument shall be made on binding post type terminals.

(b) Terminals shall be mounted so they cannot be turned in the base or frame to which applied. They shall be properly insulated from each other and other metallic parts.

(c) Terminals shall be suitably and plainly identified.

(d) Terminal nuts shall be so arranged that they will not come off in normal use. Suitable insulation against accidental contact shall be provided for all terminations.

10. Selecting switches.

(a) Range selecting switches shall be plainly and permanently marked to identify the range being used.

11. Measuring system.

(a) The measuring system shall consist of a push button operated, battery-powered vibrator circuit in conjunction with a zero center D'Arsonval galvanometer and a suitable null-balancing potentiometer.

12. Heating.

(a) Instruments shall not overheat or show an appreciable error when operating continuously under short circuit conditions.

13. *Errors due to temperature.*

(a) Instruments furnished in accordance with this specification must be so designed that error due to changes in temperature between 4 deg. F. below zero and 122 deg. F. above zero shall not exceed 2 per cent of full scale value.

14. *Accuracy.*

(a) All instruments shall be tested at 77 deg. F.

(b) Instruments in Classes 1 and 2 shall be inherently accurate to within 1 per cent of full scale value.

(c) Instruments in Class 3 shall be inherently accurate to within 2 per cent of full scale value.

15. *Operating characteristics.*

(a) The test potential or current produced by the instrument and passed through the earth shall be alternating (periodically reversing) and of such frequency that d.c. potentials or currents or a.c. potentials or currents of commercial and beat frequencies between the test frequency and frequencies present in the earth in the test area, will have negligible effect on the accuracy of the instrument.

(b) Instruments furnished in accordance with this specification shall accurately measure ground resistance directly, unaffected by the resistance of leads and reference rods or by the position of instrument.

16. *Dielectric requirements.*

(a) The instrument assembled shall withstand for 1 minute an insulation test, at place of manufacture, of 1,000 volts a.c. between all parts of electric circuits and other metallic parts insulated therefrom.

17. *Finish.*

(a) Metal parts shall be protected against corrosion except where such protection will interfere with the proper functioning of that part.

(b) Material used for protection against corrosion shall neither melt nor flake under ordinary conditions between temperatures of 40 deg. F. below zero and 185 deg. F. above zero.

18. *Case.*

(a) Instrument case shall be constructed with close fitting joints to minimize the entrance of dust and moisture, and shall have a neat and durable finish.

19. *Sealing.*

(a) Instruments shall be sealed to prevent any changes or adjustments except by means of the zero corrector.

20. *Name plate.*

(a) Name plate showing Manufacturer's identification and serial number shall be attached to each instrument unless this information is shown on dial.

21. *Instruction plate.*

(a) Each instrument shall have permanently attached to it an instruction plate or card giving brief but complete information as to external connections and operation.

22. *Instruction manual.*

(a) Manufacturer shall provide with each instrument an instruction manual which adequately covers the operation and methods of test for which the instrument is intended.

23. *Inspection.*

(a) Purchaser may inspect the completed product to determine that the requirements of this specification have been met.

(b) If product has not been accepted at point of production and if, upon arrival at destination, it does not meet the requirements of this specification, it may be rejected, and Manufacturer, upon request, shall advise Purchaser what disposition is to be made of the rejected product. Manufacturer shall pay all shipping charges.

(c) If Purchaser is to make inspection at point of production it shall be so stated on Purchaser's order.

24. *Packing.*

(a) Product shall be so assembled or packed as to permit convenient handling and to protect against loss or damage during shipment.

25. *Marking.*

(a) Purchaser's order, requisition and package number, name of Consignor, and name and address of Consignee, shall be plainly marked on outside of package.

26. *Warranty.*

(a) Manufacturer shall warrant the product covered by this specification to be free from defects in material and workmanship under ordinary use and service, his obligation under this warranty being limited to manufacturing, at point of production, any part or parts to replace those which shall be found defective within 1 year after shipment to Purchaser. This warranty shall not apply to any product which shall have been repaired or altered in any way by anyone other than Manufacturer thereof, so as to affect, in Manufacturer's judgment, its proper functioning or reliability, or which has been subjected to misuse, negligence or accident.

Action Recommended

Acceptance for submission to letter ballot.

(Revision of General Classification for Signal Failures and Signal Interruptions)
A.A.R. SIGNAL SECTION INSTRUCTIONS.

GENERAL CLASSIFICATION OF SIGNAL SYSTEM FAILURES AND INTERRUPTIONS*

1953

These instructions are for the purpose of providing for a classification of signal system failures and interruptions. They set forth definitions of the several classifications and provide information to assist in preparing signal failure reports.

1. Signal system failures and interruptions, as well as potential false proceed conditions, shall be reported in accordance with the following classifications:

(a) False restrictive (FR).

1. A false restrictive failure is a failure of a system, device or appliance to indicate or function as intended which results in greater restriction than is required.

(b) False proceed (FP).

1. A false proceed failure is a failure of a system, device or appliance to indicate or function as intended which results in less restriction than is required.

(c) Potential false proceed condition (PFPC).

1. A potential false proceed condition is a condition existing in signal systems, devices or appliances, when no train is present, under which a false proceed failure would have occurred had a locomotive or train approached or entered a section of track occupied by another train or where the safety of the track was impaired.

Note.—Report may be made as instructed for creditable interruptions (CI).

1. A creditable interruption is an interruption to the normal operation of a signal system, device or appliance causing the display of a restrictive signal aspect or the operation of control equipment due to some occurrence or condition, such as a broken rail, operation of slide detector or dragging equipment detector devices and other similar causes any of which would impair the safety of train movements.

2. All items reported must include detailed information as to cause.

3. All items reported must include information as to responsibility as follows:

- (a) Signal Department (S)
- (b) Motive Power (M)
- (c) Track (T)
- (d) Other Departments (O)
- (e) Interference (I)
- (f) Elements (L)
- (g) Defects (D)
- (h) Undetermined (U)

* The term "as instructed" as used herein refers to individual railroad instructions.

4. Responsibility for each item must be established as follows:

(a) Those chargeable to the Signal Department (S) must include the following causes:

1. Failures of material maintained by the Signal Department and detectable by reasonable inspection.
2. Disarrangement or improper adjustment of apparatus or parts maintained by the Signal Department.
3. Acts or omissions by employees of the Signal Department.

(b) Those chargeable to Motive Power (M), Track (T), and Other Departments (O), must include the following causes:

1. Failures due to material maintained by these departments.
2. Disarrangement or improper adjustment of apparatus or parts maintained by these departments.
3. Acts or omissions by employees of these departments.

Note.—Items reported due to dragging equipment must be charged to Other Departments (O) unless it is definitely determined that they were due to dragging equipment on engines or locomotives in which case they must be charged to Motive Power (M).

(c) Those chargeable to Interference (I) must include the following causes:

1. Foreign current.
2. Wires being broken or crossed by blasting, falling trees, etc., or by acts of persons other than railroad employees.
3. Malicious acts such as stealing line wire, inductors, cutting or stealing bond wires, etc., and placing obstructions in switches or other apparatus.

(d) Those chargeable to Elements (L) must include causes due to storms, floods, frost, ice, lightning, rain, drifting sand, sleet, snow, wind, etc.

(e) Those chargeable to Defects (D) must include causes due to improper design of signal equipment and apparatus or defects in signal equipment, material or apparatus maintained by the Signal Department and not detectable by reasonable inspection.

(f) Those chargeable to Undertermined (U) must include those for which a cause cannot be assigned after thorough investigation.

Action Recommended

Acceptance for submission to letter ballot superseding subject-matter
in the Manual.

Subject-matter to be Superseded

General Classification for Signal Failures and Signal Interruptions,
Manual Part 52.

GUIDE FOR DETERMINING PERFORMANCE AND EFFICIENCY OF SIGNAL SYSTEMS

It is believed that occasions may arise on many railroads where they would find it desirable to consider a study of the service being obtained by use of the signal system or systems which they operate.

Such studies may be beneficial from the standpoint of analyzing the trend over a period of time relative to the types of failures or interruptions that occur for different types of equipment or that may be due to a particular cause.

Studies of this nature can reveal specific needs for special or improved maintenance and for improvement of installation practices as well as for improvement in manufacturing design and elimination of defects in material. These studies could result in better cooperation by other departments involved in the use of and maintenance of equipment which, by its failure, causes failures and interruptions to signal systems.

The revision to Manual Part 52 submitted separately in this Advance Notice makes available a carefully prepared set of instructions for the purpose of providing a classification of signal system failures and interruptions in a manner which should result in consistent and comparable data being recorded. These data should supply information in a general way as to causes and responsibility therefor.

For study purposes, the data obtained as to causes can be broken down into groups for any additional special information that might be desired. A typical group of subdivisions of causes that could be of benefit to all roads would be:

1. Sand, rust, or other deposit on rails.
2. Failures of relays and similar devices.
3. Wires broken, open, circuits crossed or grounded, foreign current, etc.
4. Apparatus broken, defective or out of adjustment.
5. Failures of apparatus due to sleet, ice, snow, wet track, weather, or lightning.
6. Failures of apparatus due to obstruction.
7. Errors in making connections or adjustments.
8. Failures of rail bonding.
9. Failures of signal lights.
10. Undetermined.

Other subdivisions could be made as required.

If an additional record of the total operations or movements of controlled apparatus is made, and compared with the total failures or interruptions for such apparatus for a given period, a ratio can be obtained which will indicate the efficiency of the apparatus in the system. Such information can be very valuable and important for all who are concerned with possibly improving signal system performance and efficiency.

Action Recommended

Acceptance as information.

COOPERATIVE REPORT

AMERICAN STANDARDS ASSOCIATION
GRAPHICAL SYMBOLS AND DESIGNATIONS
PROJECT Y32

F. Youngwerth, Representative

A meeting of A.S.A. Sectional Committee Y32, Graphical Symbols and Designations, was held December 4, 1952 at New York, N. Y., at which progress reports of various Task Groups were presented.

A.S.A. By-laws provide for at least every 3 years for sectional committees to review all standards with a view to reaffirmation or revision. Standard Z32.2.5—Graphical Symbols for Railroad Use was on the agenda for reaffirmation. Your representative called the attention of the Committee to the fact that this Standard did not meet the present requirements of the railroad industry and recommended it be considered for revision. The recommendation was accepted and assigned by the Chairman of Sectional Committee Y32 to a task force for their review and revision. Your representative will head this Subgroup.

Action Recommended

Acceptance as information.

COOPERATIVE REPORT

AMERICAN STANDARDS ASSOCIATION
DEFINITIONS OF ELECTRICAL TERMS
PROJECT C42—SUBGROUP 8

F. Youngwerth, Representative

Revised drafts of Sections 46, 51 and 56, Definitions of Electrical Terms of the American Standards Association, Group C42, have been submitted to Chairmen of the other A.S.A. Sectional Committees, certain Chairmen of A.I.E.E. technical committees and the National Security Resource Board, for review and approval or comment. To date final approval of the aforementioned sections has not been received.

Your representative received copy of draft "Signaling and Other Electrical Security Apparatus for Railways" prepared by the French Electro-technical Committee, Group 31, for review and comment. Your representative's comments were referred to a Preparatory Subcommittee of the A.S.A. for their further handling with the International Electro-technical Commission.

Action Recommended

Acceptance as information.

COMMITTEE VI—DESIGNS

Personnel

W. G. Brown, Chairman

C. J. R. Taylor, Vice-Chairman

H. Alexander	H. P. Schmidt
R. I. Becksted	P. E. Snead
E. F. Brown	D. B. Thomas
W. A. Ford	C. C. Thorn
B. C. Hallowell	T. W. Tizzard
W. T. Lewis	C. H. Tobin
J. C. Lummis	W. J. Varner
J. M. Rice	A. J. Yarrell

A. P. Young

Signal Section, A.A.R.:

The following outline of work has been assigned:

1. Revision of Manual.
2. Indexing signal literature.
3. Designs.
4. Specifications and drawings covering reflector lenses and similar devices for signals and signs, collaborating with Committee VIII.
5. Simplification of sizes and kinds of electric lamps for signal purposes, cooperating with Purchases and Stores Division, A.A.R.
6. Specification for concrete for shop precast and poured in place foundations.
7. Design a universal switch adjustment bracket.
8. Design a universal adjustment bracket for application of lock rod to front rod.
9. Investigate and report on means and methods for the improvement of incandescent electric lamps used in signaling, collaborating with Committee I.
10. Design an electric switch lamp.
11. Specifications for plain and spring lock washers.

The Committee submits for consideration, reports on the following subjects*:

1. Revised drawings.
Drawing to be made obsolete.
3. New drawings.
11. Specifications for Plain and Spring Lock Washers.

Information

Specifications, etc., of other organizations referred to in the report of this Committee may be procured from the following:

A.S.A.—American Standards Association, 70 E. 45 St., New York 17, N. Y.

* Suggestions or criticisms should be submitted in writing to the Chairman of the Committee on or before August 28, 1953.

Disposition of 1952 Letter Ballot Subjects

The following subjects presented by Committee VI at the 1952 Annual Meeting were submitted to letter ballot and officially approved:

- A.A.R. Sig. Sec. 1055E—Switch-Rod Insulation—Now in Drawing Section of Manual.
- A.A.R. Sig. Sec. 1245B—Pinnacles—For 4-5-6 and 8 Inch Mast—Details and Assemblies—Now in Drawing Section of Manual.
- A.A.R. Sig. Sec. 1271B—Ball Studs—For Switch Circuit Controller—Details and Assemblies—Now in Drawing Section of Manual.
- A.A.R. Sig. Sec. 1272B—Ball Socket Screw Jaw—For Switch Circuit Controller—Details and Assembly—Now in Drawing Section of Manual.
- A.A.R. Sig. Sec. 1364E—Ladder Platforms—Details and Assemblies—Now in Drawing Section of Manual.
- A.A.R. Sig. Sec. 1399D—Low Target Stand—Details and Assembly—Now in Drawing Section of Manual.
- A.A.R. Sig. Sec. 1447B—Base for 5 Inch Mast—For Heavy Loading—Now in Drawing Section of Manual.
- A.A.R. Sig. Sec. 1463B—Cross-Arm for Extended Lights—For Flashing Light Highway Crossing Signal with Pedestal Mounted Gate—Assembly—Now in Drawing Section of Manual.
- A.A.R. Sig. Sec. 1468B—Cross-Arm for Suspended Lights—For Flashing Light Highway Crossing Signal with Mast Mounted Gate—Assemblies—Now in Drawing Section of Manual.
- A.A.R. Sig. Sec. 1489F—Highway Crossing Signal—Flashing Light Type with Suspended Lights and Mast Mounted Gate—Assembly—Now in Drawing Section of Manual.
- A.A.R. Sig. Sec. 1491E—Highway Crossing Gate Roadway Arm—For Mast Mounting—Now in Drawing Section of Manual.
- A.A.R. Sig. Sec. 1492B—Highway Crossing Gate Sidewalk Arm—For Mast Mounting—Now in Drawing Section of Manual.
- A.A.R. Sig. Sec. 1647E—Single Adapter Clamp—For Signs—4 to 8 Inch Pipe—Details—Now in Drawing Section of Manual.
- A.A.R. Sig. Sec. 1656E—Cross-Arm for Suspended Lights—For Flashing Light Highway Crossing Signals Without Gates—4 to 8 Inch Pipe—Assemblies—Now in Drawing Section of Manual.
- A.A.R. Sig. Sec. 1657E—Cross-Arms—For Flashing Light Highway Crossing Signals—4 to 8 Inch Pipe—Details—Now in Drawing Section of Manual.
- A.A.R. Sig. Sec. 1696B—Extension Brackets for Crossing Signs—Now in Drawing Section of Manual.
- A.A.R. Sig. Sec. 1542B—Incandescent Electric Lamps—Bases—Now in Drawing Section of Manual.
- A.A.R. Sig. Sec. 1471A—Junction Box Base for 5 Inch Mast—For Heavy Loading—Assembly—Now in Drawing Section of Manual.

- A.A.R. Sig. Sec. 1472A—Junction Box Base for 5 Inch Mast—For Heavy Loading—Details—Now in Drawing Section of Manual.
- A.A.R. Sig. Sec. 1513A—Take or Leave Siding Roundel—For Illuminated Indicator—Now in Drawing Section of Manual.
- A.A.R. Sig. Sec. 1514A—Electric Light Unit—For Indicators and Signs—Now in Drawing Section of Manual.
- A.A.R. Sig. Sec. 1515A—Illuminated Indicators and Signs—Front of Mast Mounting for 4 to 8 Inch Pipe—Now in Drawing Section of Manual.
- A.A.R. Sig. Sec. 1516A—Illuminated Indicators and Signs—Side of Mast Mounting for 4 to 8 Inch Pipe—Now in Drawing Section of Manual.
- Specification 51-52—Incandescent Electric Lamps—Now in Manual Part 91.
- Specification 231-52—Illuminated Indicators and Signs—Now in Manual Part 237.

REVISED DRAWINGS

- A.A.R. Sig. Sec. 1019D—Jaws—Tang Ends—Plain Ends and Adjustable Links—Details and Assemblies.
Title and details changed in accordance with latest practice.
- A.A.R. Sig. Sec. 1193C—Suspension Base for 5 Inch Mast—Details and Assembly.
Details changed in accordance with latest practice.
- A.A.R. Sig. Sec. 1424C—Ground Rods and Clamp—Details.
Title and details changed in accordance with latest practice.
- A.A.R. Sig. Sec. 1437B—Preferred Thicknesses for Uncoated Thin Flat Metals—Under 0.250 Inch.
Thicknesses based upon the 40-series of preferred numbers added and reference made to use of 80-series.
- A.A.R. Sig. Sec. 1448B—Base for 5 Inch Mast—For Light Loading—Details and Assembly.
Title and details changed in accordance with latest practice.
- A.A.R. Sig. Sec. 1462C—Highway Crossing Signal—Flashing Light Type with Extended Lights and Pedestal Mounted Gate—Assembly.
References changed. Sign legends added.
- A.A.R. Sig. Sec. 1640D—Railroad Crossing Sign—90 Degree Cast-Iron Type for 4 to 8 Inch Pipe—Details and Assembly.
Title and details changed in accordance with latest practice.
- A.A.R. Sig. Sec. 1653G—Highway Crossing Signal—Flashing Light Type with Stop on Red Signal Sign—Assembly.
Details changed in accordance with latest practice.

A.A.R. Sig. Sec. 1654G—Highway Crossing Signal—Flashing Light Type with Stop Sign—Assembly.

Details changed in accordance with latest practice.

Action Recommended

Acceptance for submission to letter ballot superseding subject-matter in the Manual.

Subject-matter to be Superseded

A.A.R. Sig. Sec. 1019C—Jaws—Tang End and Adjustable Link—Details and Assembly.

A.A.R. Sig. Sec. 1193B—Suspension Base for 5 Inch Mast.

A.A.R. Sig. Sec. 1424B—Ground Rods and Ground Pipes.

A.A.R. Sig. Sec. 1437A—Preferred Thicknesses for Uncoated Thin Flat Metals—Under 0.250 Inch.

A.A.R. Sig. Sec. 1448A—Base for 5 Inch Mast—For Light Loading.

A.A.R. Sig. Sec. 1462B—Highway Crossing Signal—Flashing Light Type with Extended Lights and Pedestal Mounted Gate—Assembly.

A.A.R. Sig. Sec. 1640C—90 Degree Cast-Iron Crossing Sign.

A.A.R. Sig. Sec. 1653F—Highway Crossing Signal—Flashing Light Type with Stop on Red Signal Sign—Assembly.

A.A.R. Sig. Sec. 1654F—Highway Crossing Signal—Flashing Light Type with Stop Sign—Assembly.

DRAWING TO BE MADE OBSOLETE

A.A.R. Sig. Sec. 1427B—Gages for Sheet Metal and Wire.

As new Drawings 1438A and 1439A give the same and more modern data, it is recommended that Drawing 1427B be removed from the Manual.

Action Recommended

Acceptance for submission to letter ballot for removal from the Manual.

NEW DRAWINGS

- A.A.R. Sig. Sec. 1273A—Adjustment Bracket—For Switch Throw Rod with Stud Fastening—Assembly.
A.A.R. Sig. Sec. 1274A—Adjustment Bracket—For Switch Throw Rod with Bolt Fastening—Assembly.
A.A.R. Sig. Sec. 1275A—Adjustment Bracket—For Switch Lock Rod with Stud Fastening—Assembly.
A.A.R. Sig. Sec. 1276A—Adjustment Bracket—For Switch Lock Rod with Bolt Fastening—Assembly.
A.A.R. Sig. Sec. 1277A—Adjustment Bracket Parts—For Switch Throw and Lock Rods—Details.
A.A.R. Sig. Sec. 1278A—Adjustment Bracket Parts—For Switch Throw and Lock Rods—Details.

Drawings prepared to provide for brackets for front and No. 1 rods along the lines of those shown on switch layouts, Figures 1 and 2, appearing on pages 142 and 143 of the 1949 Annual Meeting Advance Notice (A.A.R. Signal Section 1948 Proceedings, Vol. XLVI).

- A.A.R. Sig. Sec. 1438A—Gages and Thickness for Sheet Metal.
A.A.R. Sig. Sec. 1439A—Gages and Diameters for Wire.

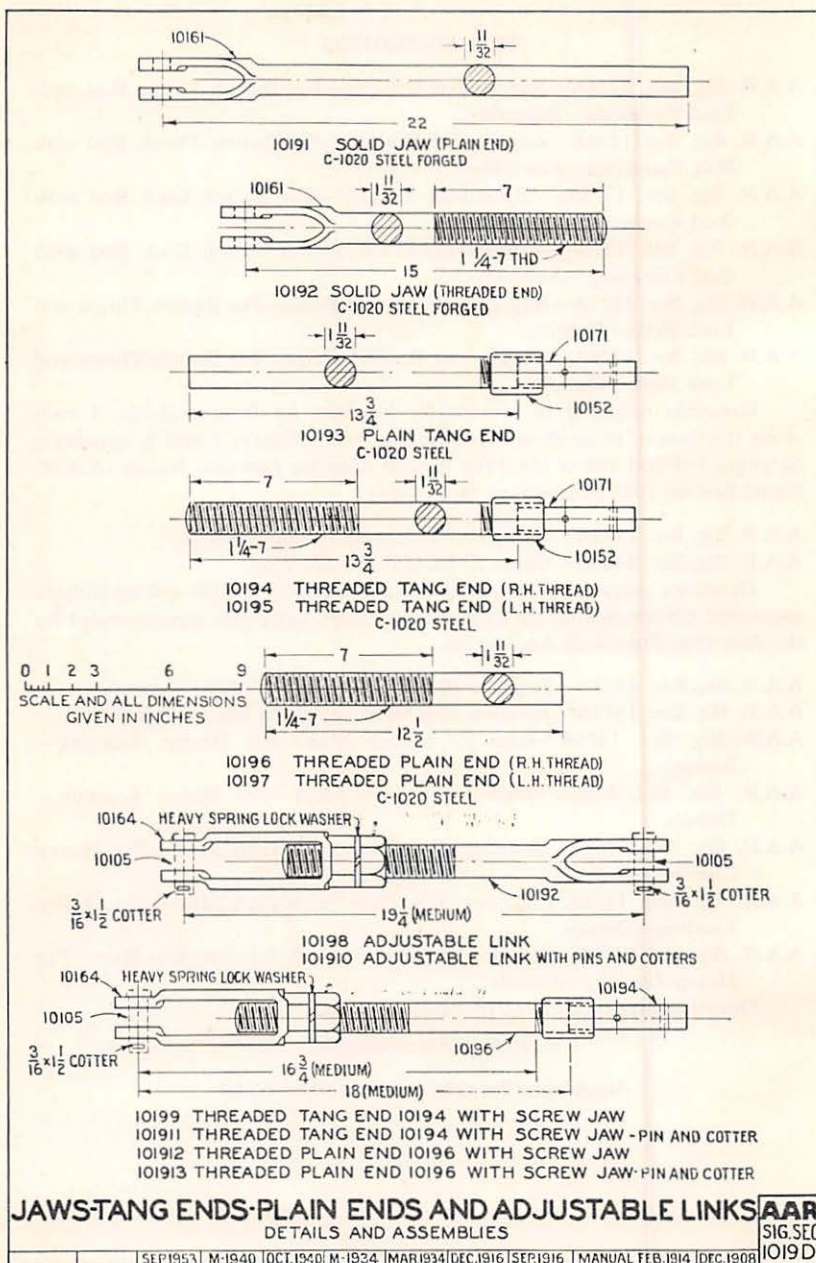
Drawings prepared in place of A.A.R. Sig. Sec. 1427B and to include gages and thicknesses on the preferred numbers basis now recommended by the American Standards Association.

- A.A.R. Sig. Sec. 1473A—Junction Box Base for 4 Inch Mast—Assembly.
A.A.R. Sig. Sec. 1474A—Junction Box Base for 4 Inch Mast—Details.
A.A.R. Sig. Sec. 1475A—Base for 6 Inch Mast—For Heavy Loading—Assembly.
A.A.R. Sig. Sec. 1476A—Base for 6 Inch Mast—For Heavy Loading—Details.
A.A.R. Sig. Sec. 1477A—Junction Box Base for 6 Inch Mast—For Heavy Loading—Assembly.
A.A.R. Sig. Sec. 1478A—Junction Box Base for 6 Inch Mast—For Heavy Loading—Details.
A.A.R. Sig. Sec. 1479A—Cap and Outlet for 6 Inch Junction Box Base—For Heavy Loading—Details.

Drawings prepared due to increasing demand.

Action Recommended

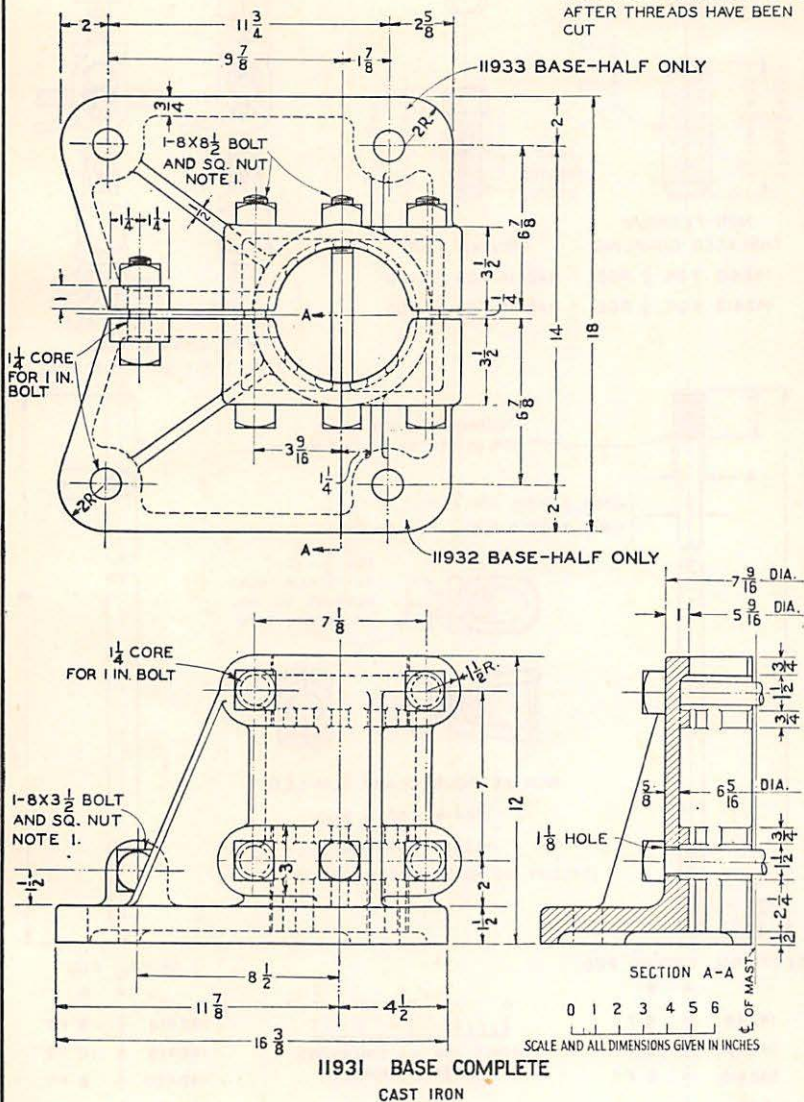
Acceptance for submission to letter ballot.



Nuts and threads shall be in accordance with Specifications for Bolts, Nuts and Threads, Manual Part 17. Spring lock washers shall be of carbon steel (A.S.A. current Specification B27.1 is preferred where practicable). Painting shall be in accordance with Specification 120, Manual Part 110.

GALVANIZE OR CADMIUM PLATE
AFTER THREADS HAVE BEEN
CUT

-11933 BASE-HALF ONLY



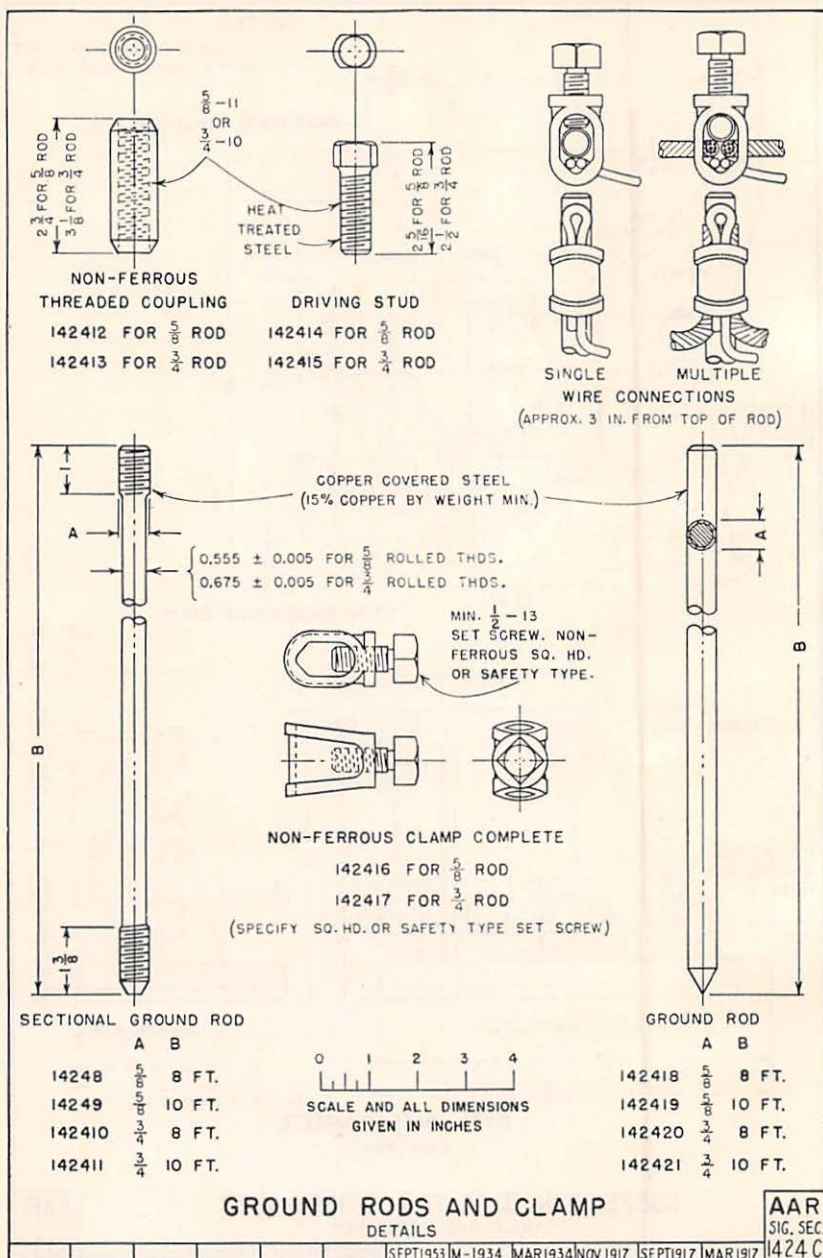
SUSPENSION BASE FOR 5 INCH MAST

DETAILS AND ASSEMBLY

AAR
SIG.SEC.
1193C

SEP. 1953	M-1941	SEP. 1941	M-1936	MAR 1936
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Cast iron shall be Class 20 in accordance with Specification for Gray Iron Castings, Manual Part 88. Bolts, nuts and threads shall be in accordance with Specifications for Bolts, Nuts and Threads, Manual Part 17. Painting shall be in accordance with Specification 120, Manual Part 110.



Threads shall be in accordance with Specifications for Bolts, Nuts and Threads,
Manual Part 17.

AMERICAN STANDARD						
B 32.1 — 1952						
THICKNESS IN INCHES						
0.236	0.125	0.063	0.032	0.016	0.008	0.004
0.224	0.118	0.060	0.030	0.015	0.007	0.003
0.212	0.112	0.056	0.028	0.014	0.006	0.003
0.200	0.106	0.053	0.026	0.013	0.006	0.003
0.190	0.100	0.050	0.025	0.012	0.006	0.003
	0.095	0.048	0.024			
0.180	0.090	0.045	0.022	0.011		
0.170	0.085	0.042	0.021			
0.160	0.080	0.040	0.020	0.010	0.005	
0.150	0.075	0.038	0.019			
0.140	0.071	0.036	0.018	0.009		
0.132	0.067	0.034	0.017			

20-series numbers are in bold-face type.

NOTE: The preferred thicknesses in this standard provide a simplified system for designating the thickness of uncoated, thin, flat metals and alloys by decimal parts of an inch, thus eliminating the confusion caused by the various gage number systems. Requirements of industry permit leeway in the choice of thickness in some instances, but it is recognized that for many applications, particularly the tonnage requirements of the mass production industries, thicknesses, more frequently than not, are determined by critical engineering design or manufacturing considerations. For these special reasons, all decimal thicknesses of metals, contingent on application, shall continue to be recognized as commercial and in no way be construed as nonstandard.

However, for general purpose applications or where requirements permit some latitude in the selection of thickness, the simplified preferred thicknesses given in the table will facilitate interchangeability of different metals in design, reduce inventory, and increase the availability in warehouse stocks of thicknesses commonly required for general-purpose applications.

The thicknesses in the table are applicable to uncoated, thin, flat metals and alloys. Each thickness is approximately the same percentage greater than the next smaller one. Based upon the 40-series of American Standard preferred numbers, they provide a coverage equivalent to previous systems, and should meet most of the general purpose needs of industry.

If intermediate thicknesses are required, selections shall be made for all metals and alloys by the use of thicknesses based on the 80-series of American Standard Preferred Numbers (Z17.1-1936).

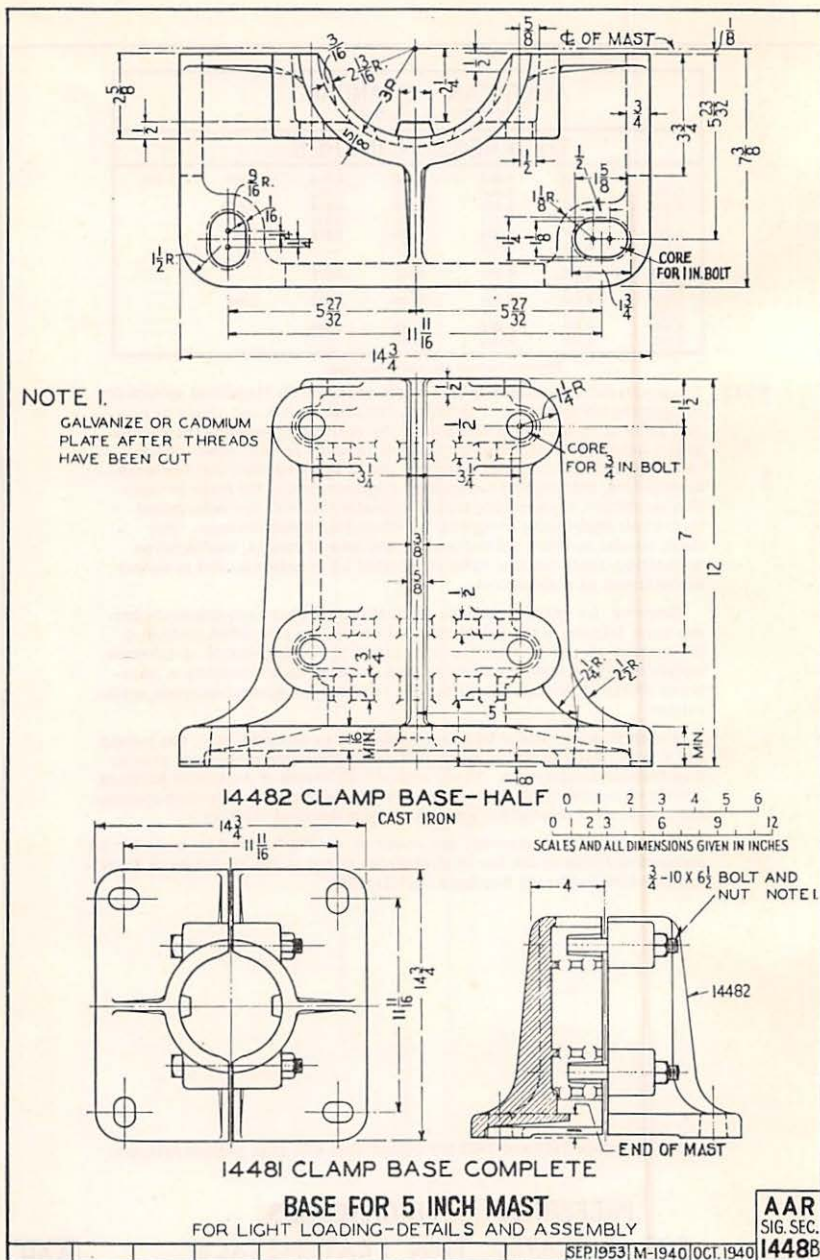
See Drawings 1438 and 1439 for comparison with gage number systems.

PREFERRED THICKNESSES
FOR UNCOATED THIN FLAT METALS
UNDER 0.250 INCH

AAR
SIG. SEC

SEP 1953 M-1942 OCT 1942

1437B



Cast iron shall be Class 20 in accordance with Specification for Gray Iron Castings, Manual Part 88. Bolts, nuts and threads shall be in accordance with Specifications for Bolts, Nuts and Threads, Manual Part 17. Painting shall be in accordance with Specification 120, Manual Part 110.

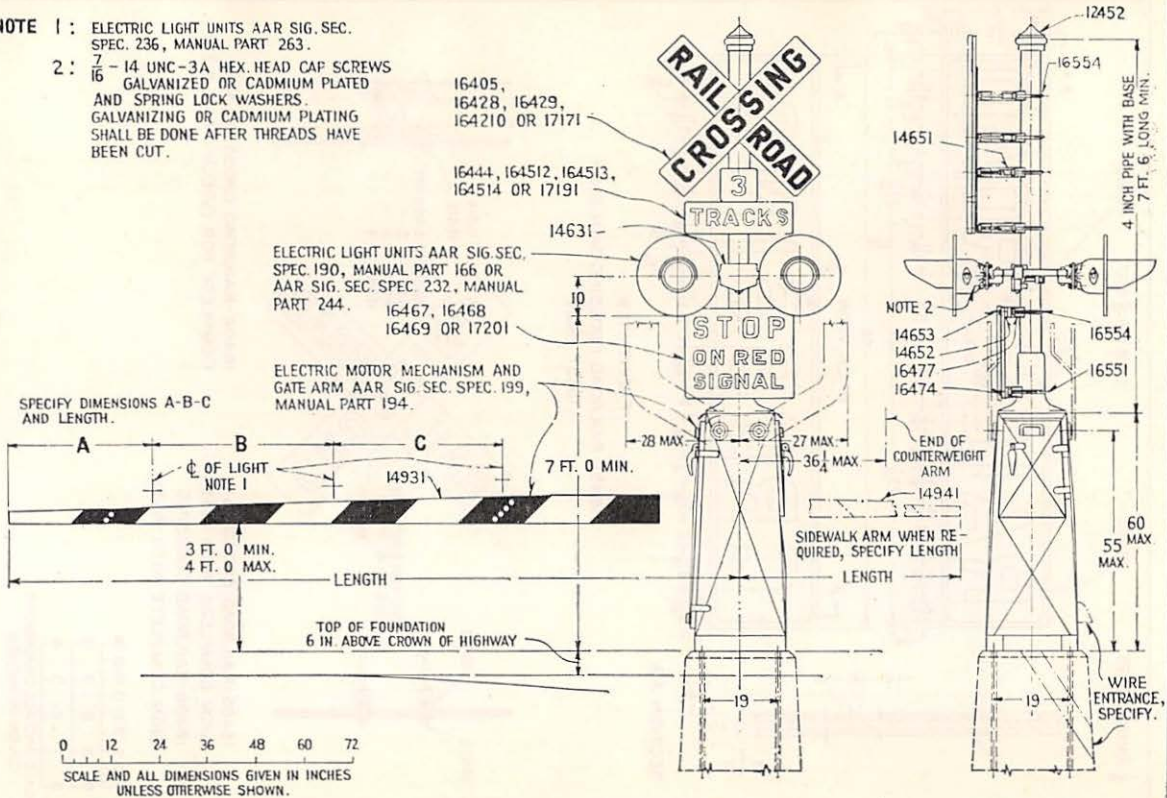
- NOTE 1 :** ELECTRIC LIGHT UNITS AAR SIG. SEC. SPEC. 236, MANUAL PART 263.
- 2 :** $\frac{7}{16}$ - 14 UNC-3A HEX. HEAD CAP SCREWS GALVANIZED OR CADMIUM PLATED AND SPRING LOCK WASHERS. GALVANIZING OR CADMIUM PLATING SHALL BE DONE AFTER THREADS HAVE BEEN CUT.

FLASHING LIGHT TYPE WITH EXTENDED LIGHTS AND PEDESTAL MOUNTED GATE - ASSEMBLY

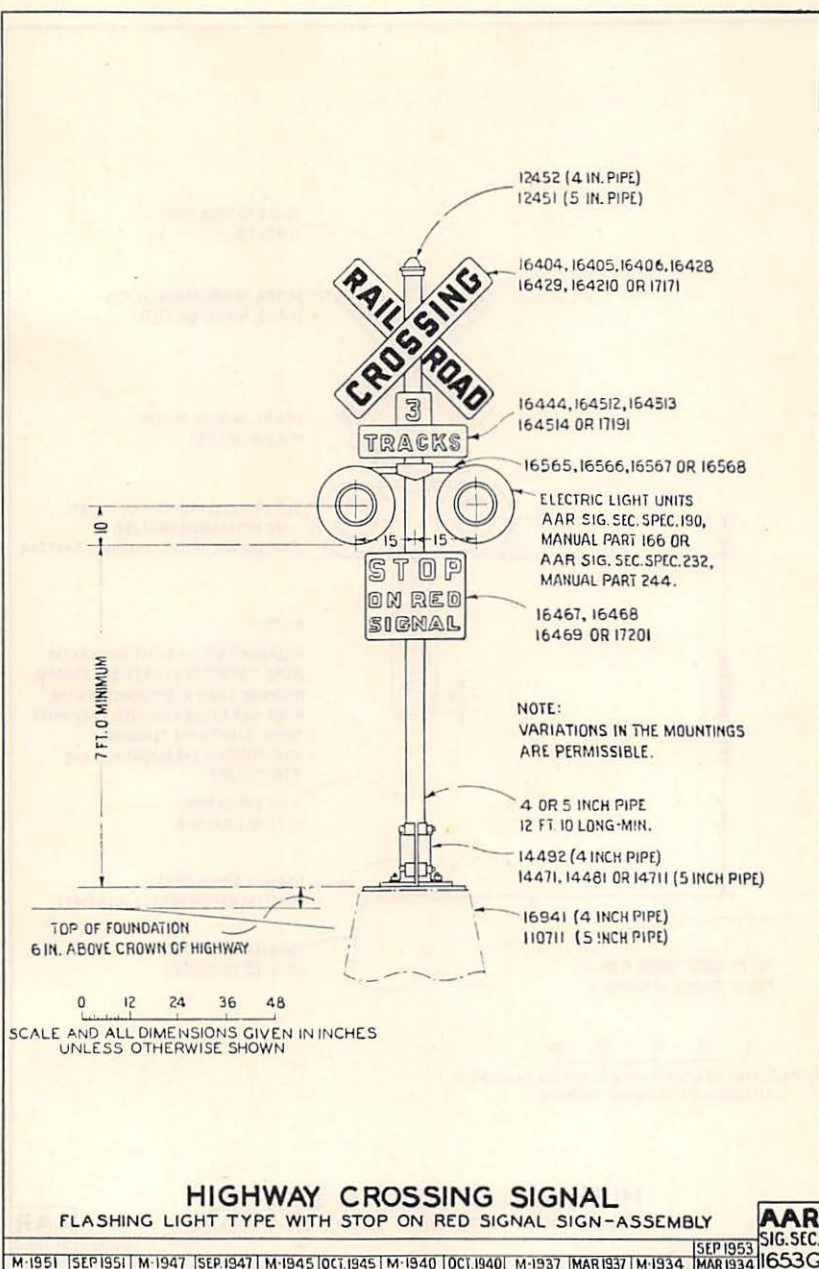
HIGHWAY CROSSING SIGNAL

SEP 1953 M-1951 SEP 1951 M-1950 SEP 1950

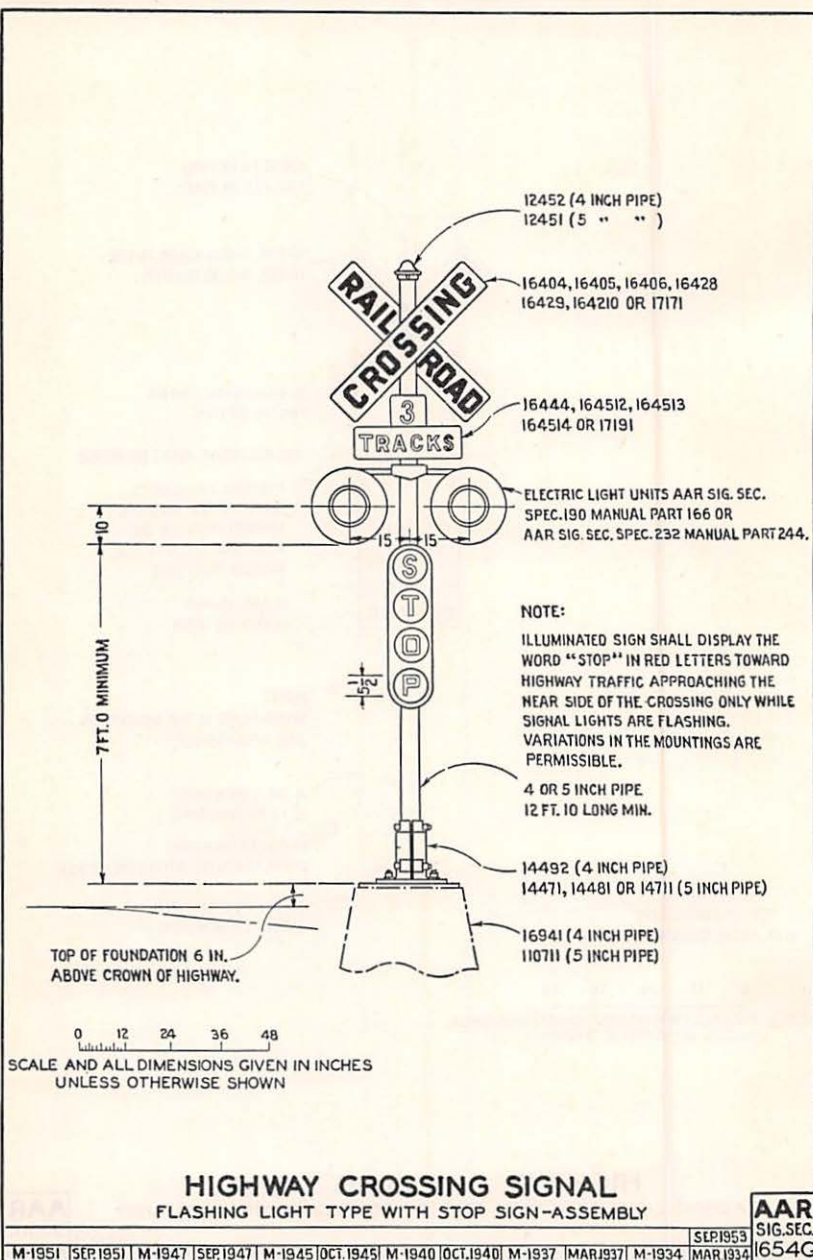
AAR
SIG. SEC.
1462C



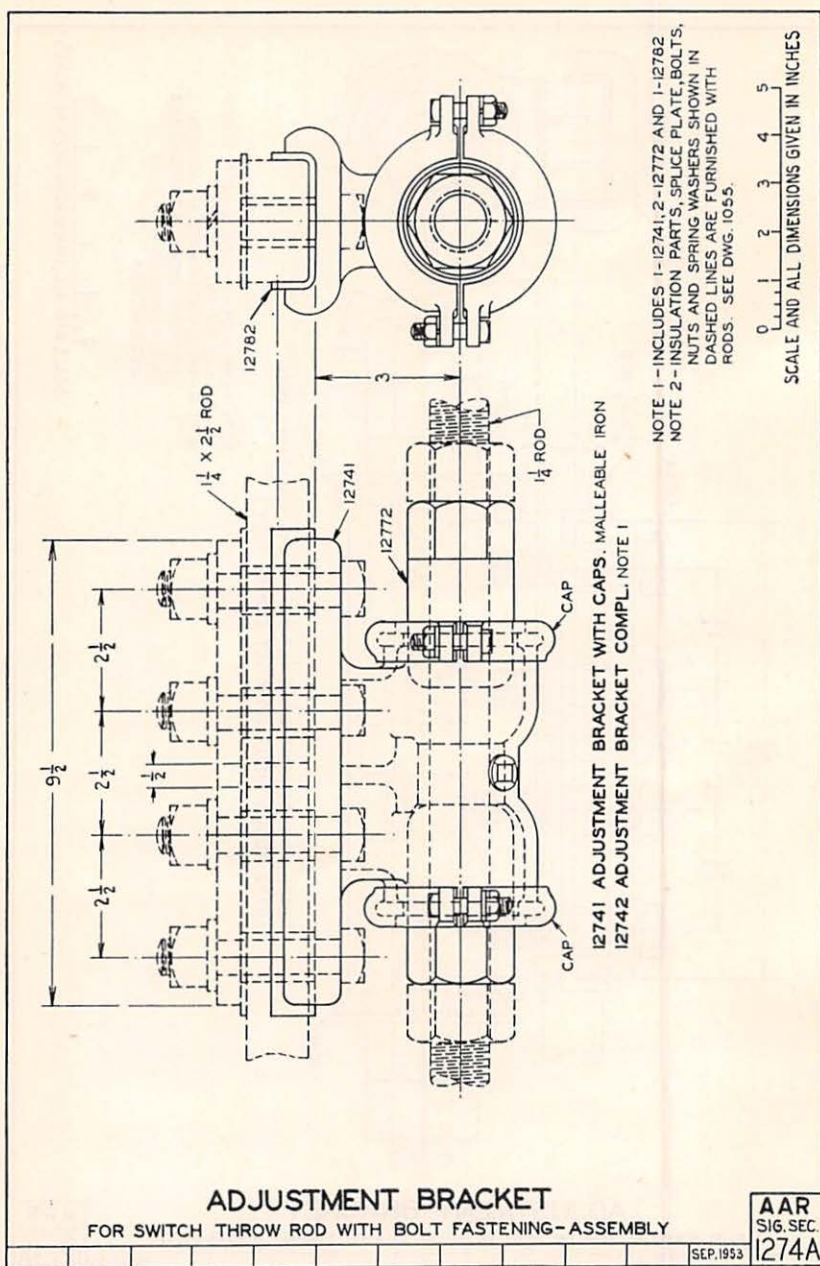
Bolts, nuts and threads shall be in accordance with Specifications for Bolts, Nuts and Threads, Manual Part 17. Spring lock washers shall be of carbon steel (A.S.A. current Specification B27.1 is preferred where practicable).



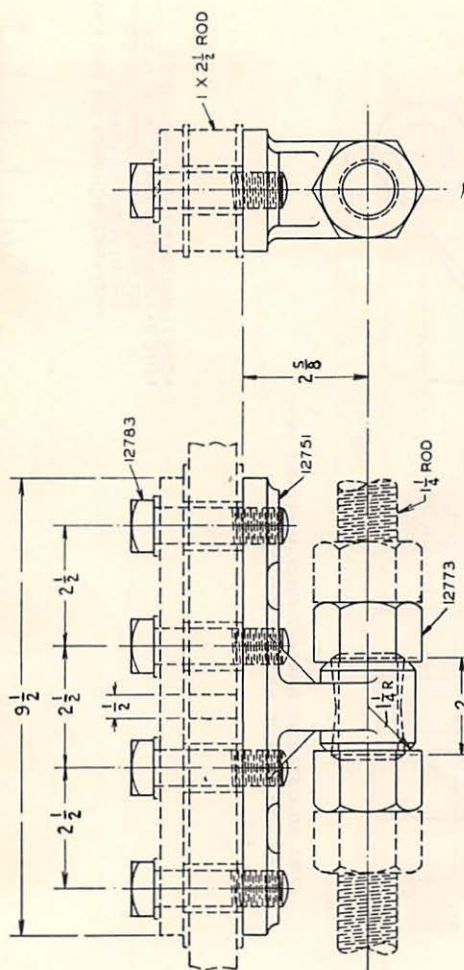
Highway crossing signal shall be in accordance with Requisites for Highway Grade Crossing Signals, Manual Part 148.



Highway crossing signal shall be in accordance with Requisites for Highway Grade Crossing Signals, Manual Part 148.



Bolts, nuts and threads shall be in accordance with Specifications for Bolts, Nuts and Threads, Manual Part 17. Painting shall be in accordance with Specification 120, Manual Part 110. Malleable iron shall be Grade 35018 in accordance with Specification for Malleable Iron Castings, Manual Part 89. Spring lock washers shall be of carbon steel (A.S.A. current Specification B27.1 is preferred where practicable).



12751 ADJUSTMENT BRACKET ONLY. MALLEABLE IRON.
12752 ADJUSTMENT BRACKET COMPL. NOTE 1

NOTE 1- INCLUDES 1-12751, 2-12773 AND 4-12783
NOTE 2- INSULATION PARTS, SPlice PLATE AND
SPRING WASHERS SHOWN IN DASHED
LINES ARE FURNISHED WITH RODS.
SEE DWG. 1055.

0 1 2 3 4 5
SCALE AND ALL DIMENSIONS GIVEN IN INCHES

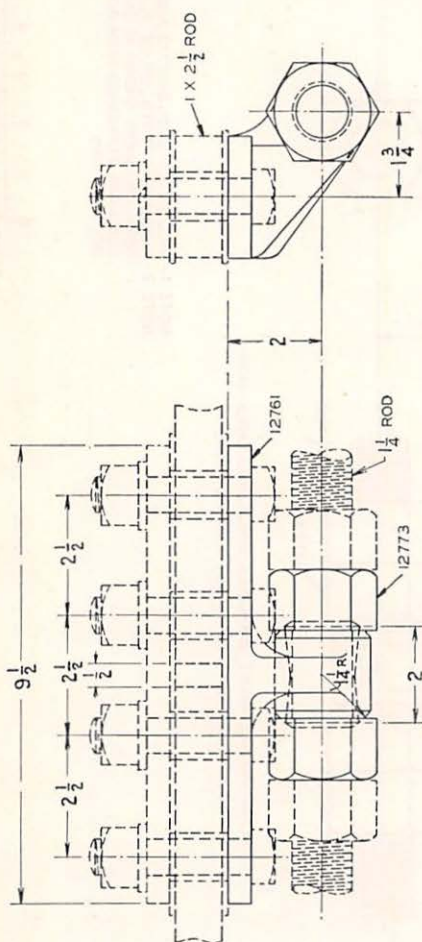
ADJUSTMENT BRACKET

FOR SWITCH LOCK ROD WITH STUD FASTENING-ASSEMBLY

AAR
SIG. SEC
1275A

SEP. 1953

Threads shall be in accordance with Specifications for Bolts, Nuts and Threads, Manual Part 17. Painting shall be in accordance with Specification 120, Manual Part 110. Malleable iron shall be Grade 35018 in accordance with Specification for Malleable Iron Castings, Manual Part 89.



12761 ADJUSTMENT BRACKET ONLY. MALLEABLE IRON.
12762 ADJUSTMENT BRACKET COMPL. NOTE 1

NOTE 1 - INCLUDES 1-12761 AND 2-12773
NOTE 2 - INSULATION PARTS, SPLICE PLATE,
BOLTS, NUTS AND SPRING WASHERS
SHOWN IN DASHED LINES ARE
FURNISHED WITH RODS. SEE DWG. 1055.

0 1 2 3 4 5
SCALE AND ALL DIMENSIONS GIVEN IN INCHES

ADJUSTMENT BRACKET

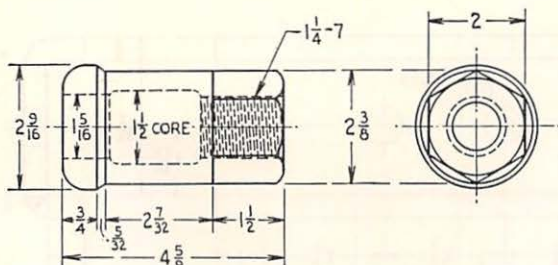
FOR SWITCH LOCK ROD WITH BOLT FASTENING-ASSEMBLY

AAR
SIG. SEC.

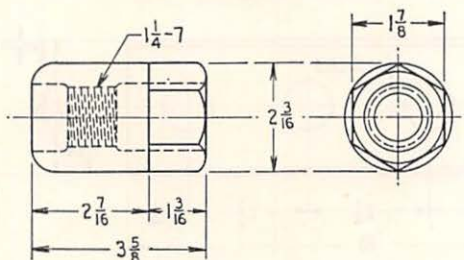
SEP. 1953

1276A

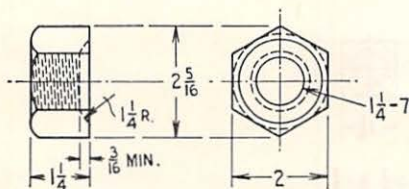
Painting shall be in accordance with Specification 120, Manual Part 110. Malleable iron shall be Grade 35018 in accordance with Specification for Malleable Iron Castings, Manual Part 89.



12771 ADJUSTING NUT
MALLEABLE IRON



12772 ADJUSTING NUT
MALLEABLE IRON



12773 ADJUSTING NUT
C-1020 STEEL

0 1 2 3 4 5
SCALE AND ALL DIMENSIONS GIVEN IN INCHES

ADJUSTMENT BRACKET PARTS
FOR SWITCH THROW AND LOCK RODS—DETAILS

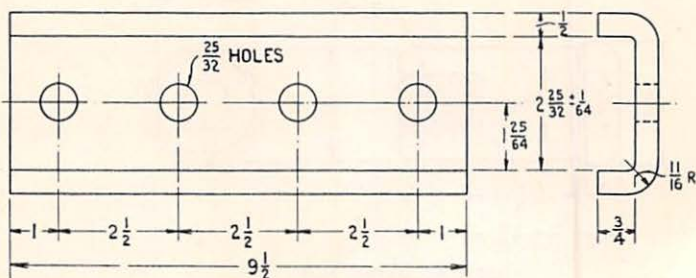
AAR
SIG. SEC.

SEP. 1953

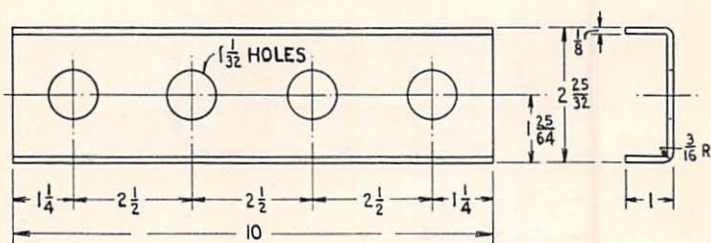
1277A

See Drawing 1278.

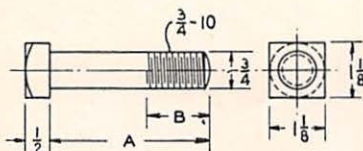
Threads shall be in accordance with Specifications for Bolts, Nuts and Threads, Manual Part 17. Malleable iron shall be Grade 35018 in accordance with Specification for Malleable Iron Castings, Manual Part 89.



12781 CHANNEL, C 1020 STEEL



12782 INSULATION PLATE, FIBRE

12783 BOLT, A=2 $\frac{3}{4}$ B= $\frac{7}{8}$ 12784 BOLT, A=3 $\frac{1}{4}$ B= $\frac{1}{8}$

0 1 2 3 4 5
SCALE AND ALL DIMENSIONS GIVEN IN INCHES

ADJUSTMENT BRACKET PARTS FOR SWITCH THROW AND LOCK RODS-DETAILS

AAR
SIG. SEC.
1278A

SEP. 1953

See Drawing 1277.

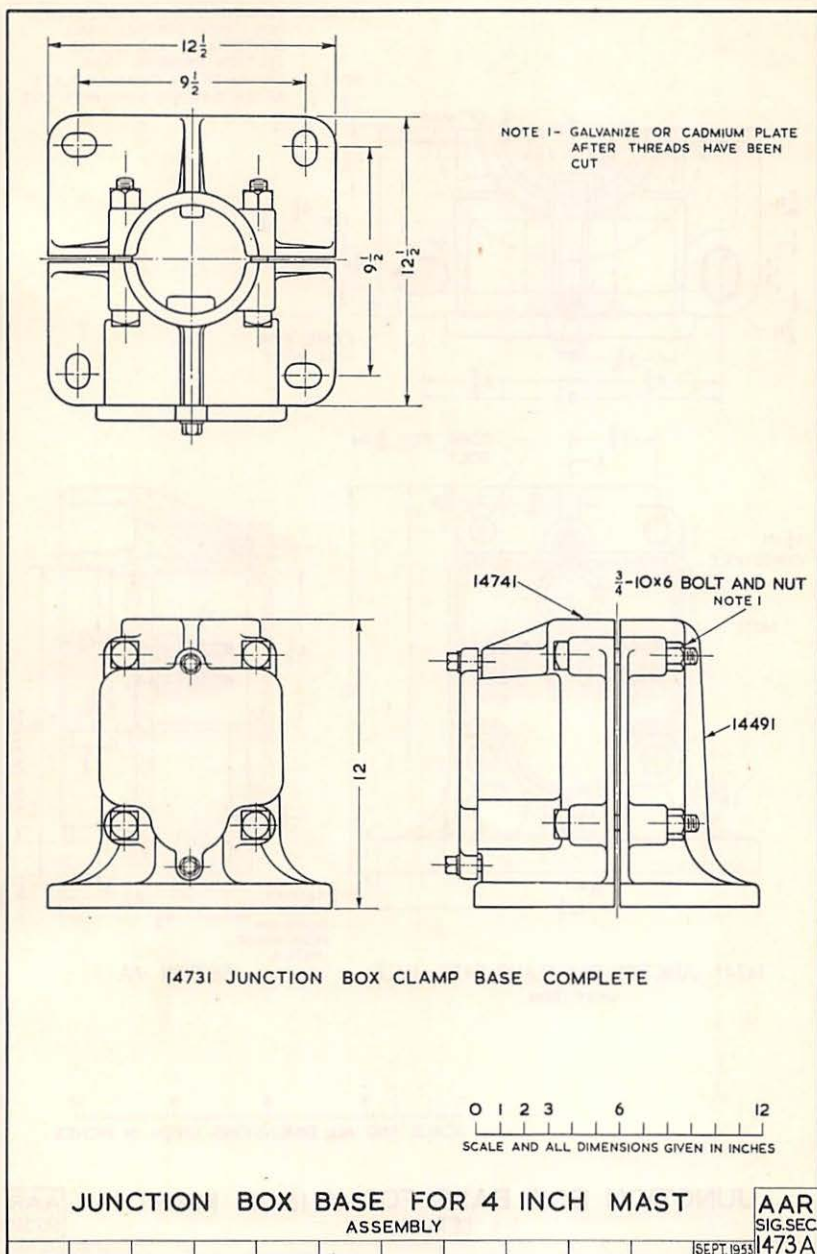
Fibre shall be in accordance with Specification 13, Manual Part 58. Bolt and threads shall be in accordance with Specifications for Bolts, Nuts and Threads, Manual Part 17.

GAGE NO.	INCH EQUIVALENT THICKNESS			PREFERRED NUMBERS * IN DECIMALS 80 SERIES 3% STEPS	
	SHEET & PLATE FERROUS		SHEET & PLATE NON-FERROUS		
	U.S. ST'D	MFR'S ST'D (AISI)	AMER. ST'D (B & S)		
7-0	.500		.6510	10	31.5
6-0	.469		.5800	10.3	32.5
5-0	.438		.5165	10.6	33.5
4-0	.406		.4600	10.9	34.5
3-0	.375		.4096	11.2	35.5
2-0	.344		.3648	11.5	36.5
0	.312		.3249	11.8	37.5
1	.2812		.2893	12.1	38.7
2	.2656		.2576	12.5	40
3	.2500	.2391	.2294	12.8	41.2
4	.2344	.2242	.2043	13.2	42.5
5	.2188	.2092	.1819	13.6	43.7
6	.2031	.1943	.1620	14	45
7	.1875	.1793	.1443	14.5	46.2
8	.1719	.1644	.1285	15	47.5
9	.1562	.1495	.1144	15.5	48.7
10	.1406	.1345	.1019	16	50
11	.1250	.1196	.09074	16.5	51.5
12	.1094	.1046	.08081	17	53
13	.0938	.0897	.07196	17.5	54.5
14	.0781	.0747	.06408	18	56
15	.0703	.0673	.05707	18.5	58
16	.0625	.0598	.05082	19	60
17	.0562	.0538	.04526	19.5	61.5
18	.0500	.0478	.04030	20	63
19	.0438	.0418	.03569	20.6	65
20	.0375	.0359	.03196	21.2	67
21	.0344	.0329	.02646	21.8	69
22	.0312	.0299	.02535	22.4	71
23	.0281	.0269	.02257	23	73
24	.0250	.0239	.0201	23.6	75
25	.0219	.0209	.0179	24.3	77.5
26	.0188	.0179	.01594	25	80
27	.0172	.0164	.01420	25.7	82.5
28	.0156	.0149	.01264	26.5	85
29	.0141	.0135	.01126	27.2	87.5
30	.0125	.0120	.01003	28	90
31	.0109	.0105	.00893	29	92.5
32	.0102	.0097	.00795	30	95
33	.0094	.0090	.00708	30.7	97.5
34	.0086	.0082	.006304		
35	.0078	.0075	.005614		
36	.0070	.0067	.005		
37	.0066	.0064	.004453		
38	.0062	.0060	.003965		
39	.0059		.0035		
40	.0055		.0031		
GAGES AND THICKNESS FOR SHEET METAL					
				AAR SIG. SEC.	1438A
				SEP 1953	

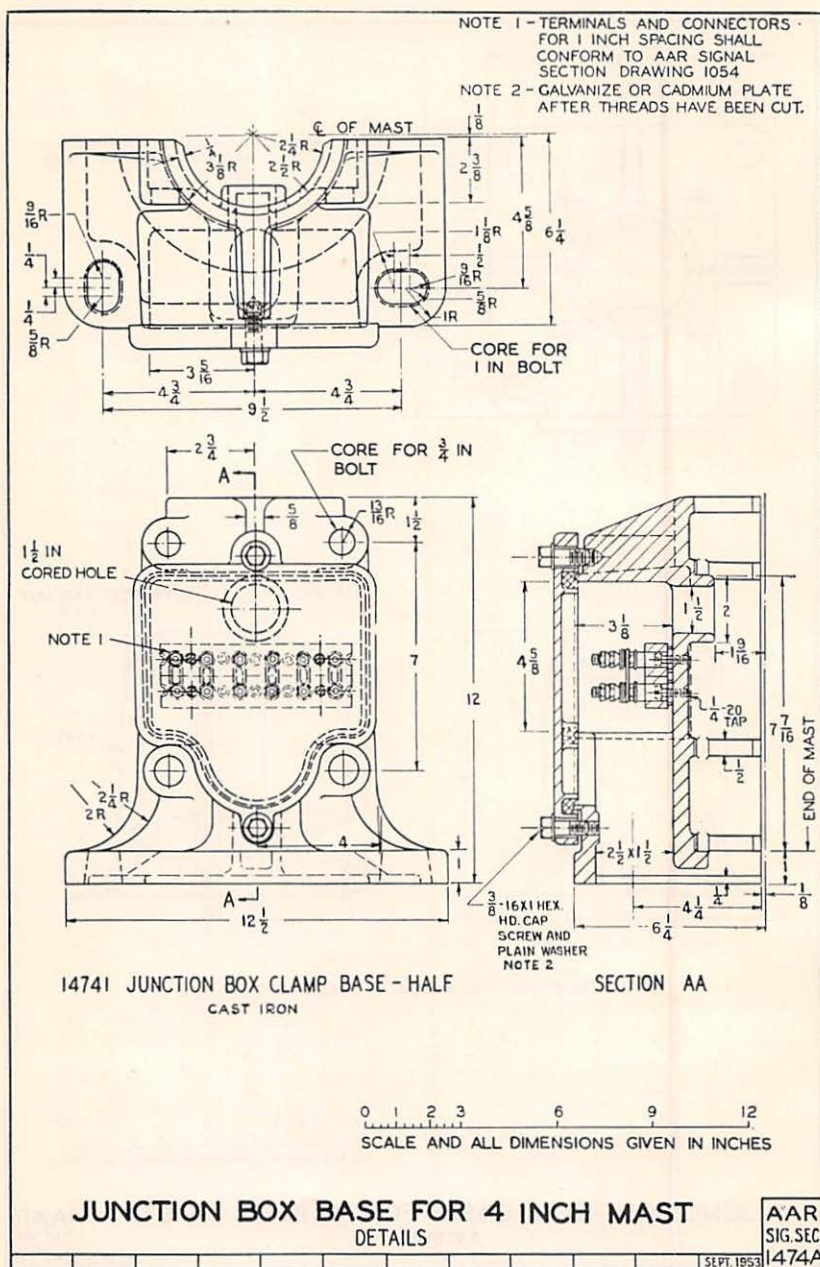
*American Standard Preferred Numbers Z17.1-1936.
See also Drawing 1437.

GAGE NO.	INCH EQUIVALENT DIAMETERS			PREFERRED NUMBERS* IN DECIMALS 80 SERIES 3% STEPS	
	AMER. WIRE (AWG) BROWN & SHARPE (B & S)	STEEL WIRE (STL. W.G.) WASHBURN & MOEN (W&M)	BIRMINGHAM STUBS (BWG)		
7-0	.6510			10	31.5
6-0	.5800	.4615		10.3	32.5
5-0	.5165	.4306		10.6	33.5
4-0	.4600	.3938	.454	10.9	34.5
3-0	.4096	.3625	.425	11.2	35.5
2-0	.3648	.331	.380	11.5	36.5
0	.3249	.3065	.340	11.8	37.5
1	.2993	.283	.300	12.1	38.7
2	.2576	.2625	.284	12.5	40
3	.2294	.2437	.259	12.8	41.2
4	.2043	.2253	.238	13.2	42.5
5	.1819	.207	.220	13.6	43.7
6	.1620	.192	.203	14	45
7	.1443	.177	.180	14.5	46.2
8	.1285	.162	.165	15	47.5
9	.1144	.1483	.148	15.5	48.7
10	.1019	.135	.134	16	50
11	.09074	.1205	.120	16.5	51.5
12	.08091	.1055	.109	17	53
13	.07196	.0915	.095	17.5	54.5
14	.06403	.080	.083	18	56
15	.05707	.072	.072	18.5	58
16	.05092	.0625	.065	19	60
17	.04526	.054	.058	20.6	65
18	.04030	.0475	.049	21.2	67
19	.03539	.041	.042	21.8	69
20	.03196	.0348	.035	22.4	71
21	.02846	.0317	.032	23	73
22	.02535	.0286	.028	23.6	75
23	.02257	.0258	.025	24.3	77.5
24	.0201	.023	.022	25	80
25	.0179	.0204	.020	25.7	82.5
26	.01594	.0181	.018	26.5	85
27	.01420	.0173	.016	27.2	87.5
28	.01264	.0162	.014	28	90
29	.01126	.015	.013	29	92.5
30	.01003	.014	.012	30	95
31	.00893	.0132	.010	30.7	97.5
32	.00795	.0128	.009		
33	.00708	.0118	.008		
34	.006304	.0104	.007		
35	.005614	.0095	.005		
36	.005	.009	.004		
37	.004453	.0085			
38	.003965	.008			
39	.0035	.0075			
40	.0031	.0070			
41	.0028				
42	.0025				
43	.0022				
44	.0020				
45	.00176				
46	.00157				
GAGES AND DIAMETERS FOR WIRE					AAR SIG SEC. 1439A
					SEP1953

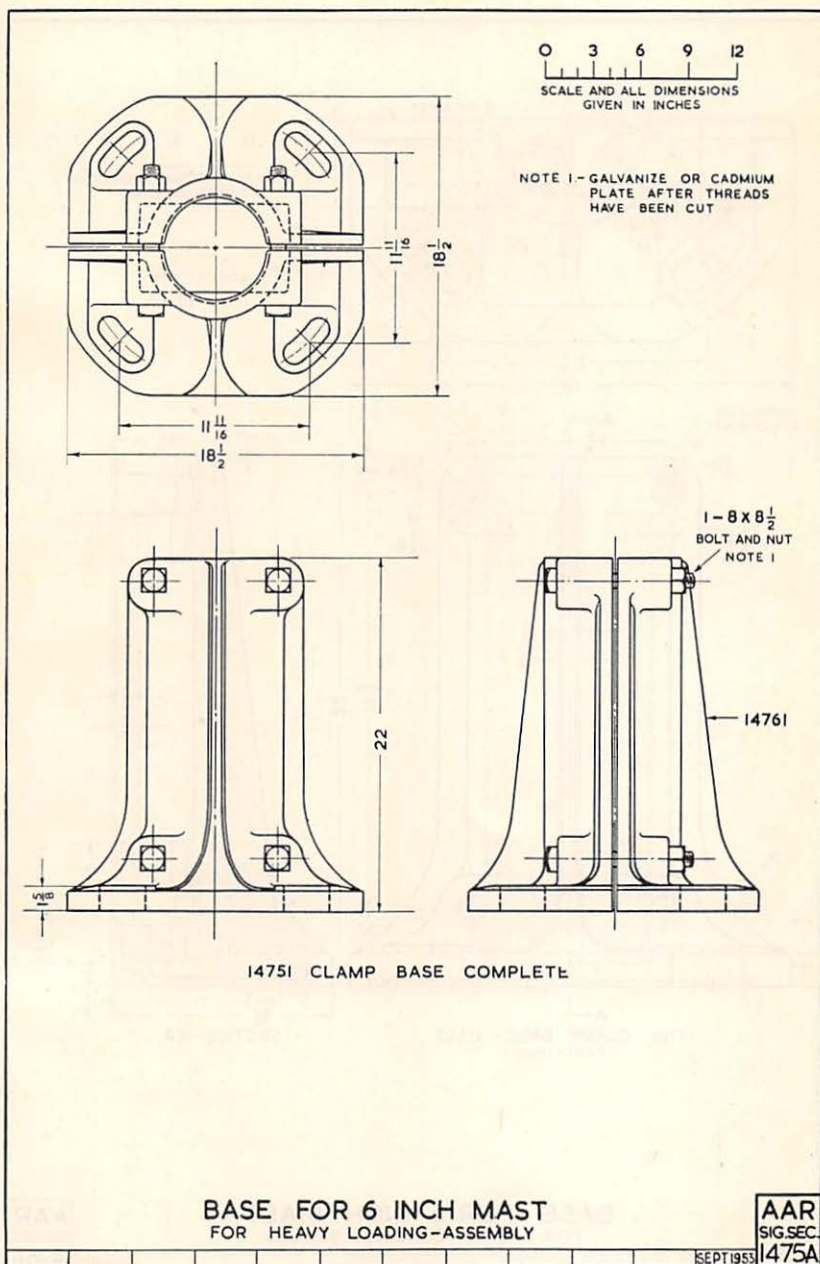
* American Standard Preferred Numbers Z17.1-1936.
See also Drawing 1437.



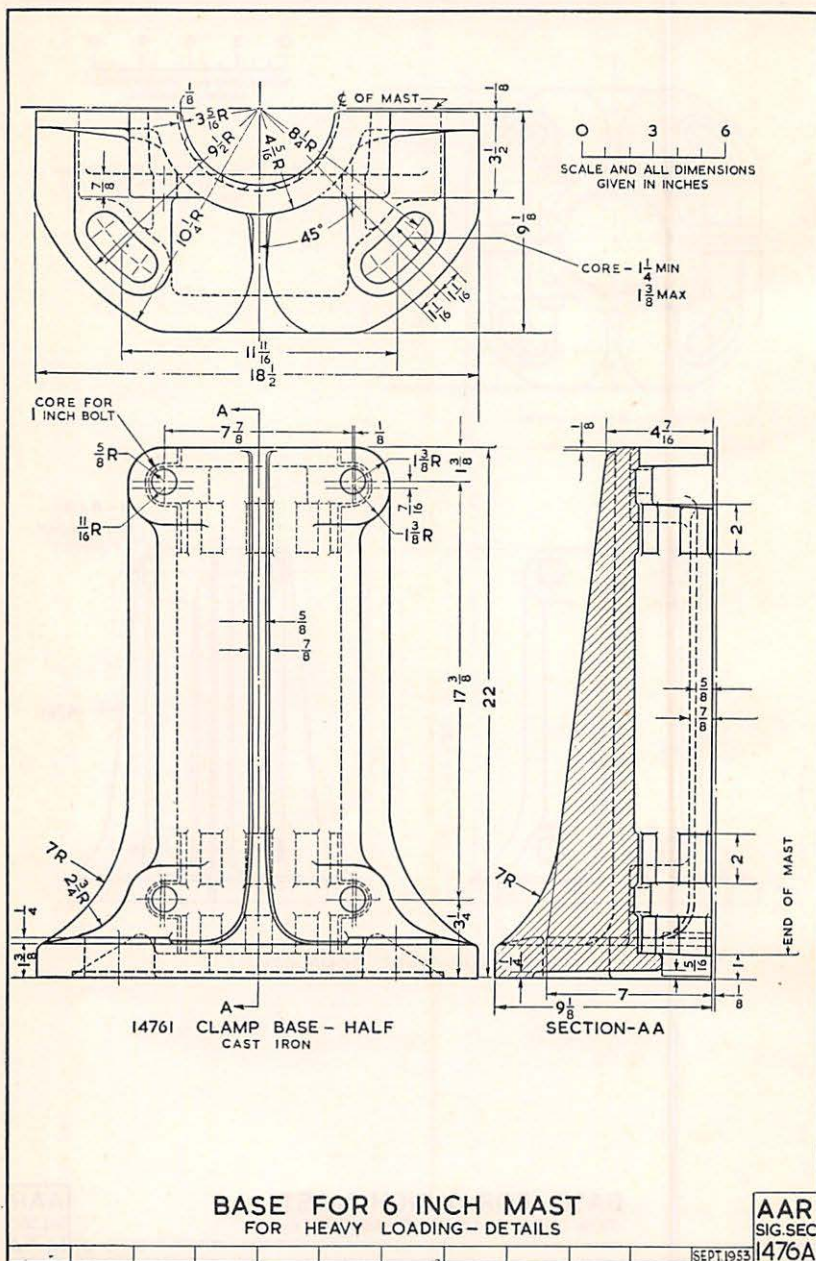
Bolts, nuts and threads shall be in accordance with Specifications for Bolts, Nuts and Threads,
Manual Part 17.



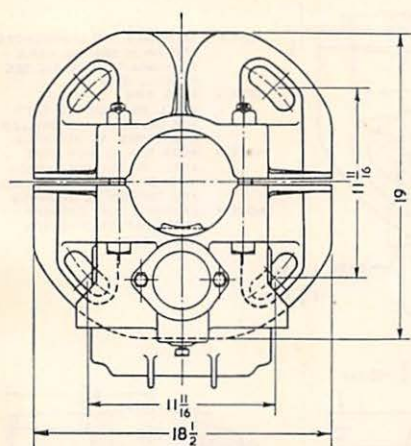
Cast iron shall be Class 20 in accordance with Specification for Gray Iron Castings, Manual Part 88. Bolts, nuts and threads shall be in accordance with Specifications for Bolts, Nuts and Threads, Manual Part 17. Painting shall be in accordance with Specification 120, Manual Part 110.



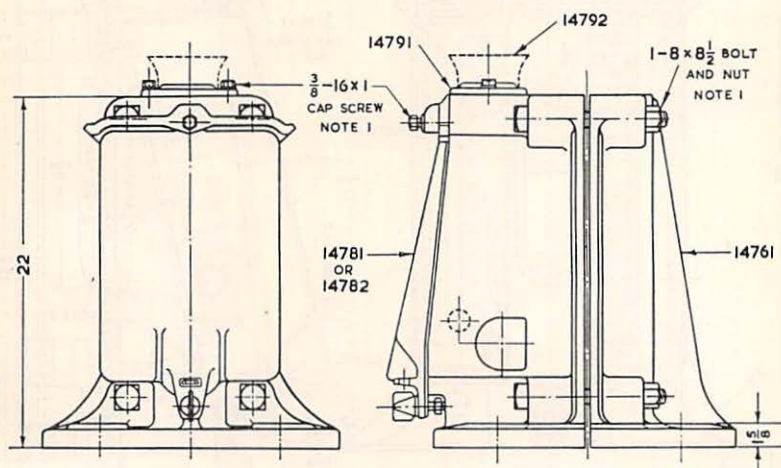
Bolts, nuts and threads shall be in accordance with Specifications for Bolts, Nuts and Threads, Manual Part 17.



Cast iron shall be Class 20 in accordance with Specification for Gray Iron Castings, Manual Part 88. Painting shall be in accordance with Specification 120, Manual Part 110.



NOTE 1 GALVANIZE OR CADMIUM
PLATE AFTER THREADS
HAVE BEEN CUT



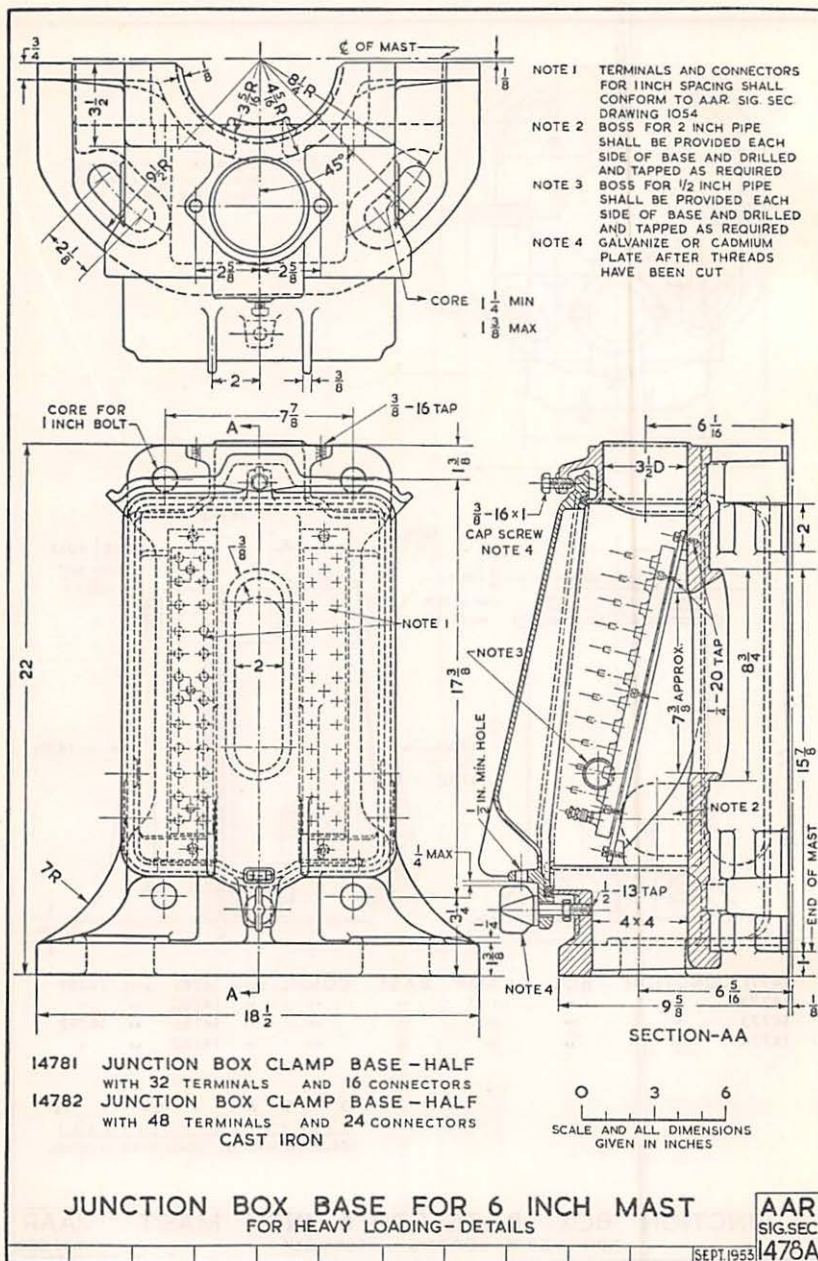
14771	JUNCTION	BOX	CLAMP	BASE	COMPL. WITH	14781	AND	14791
14772	"	"	"	"	"	14782	"	"
14773	"	"	"	"	"	14781	"	14792
14774	"	"	"	"	"	14782	"	"

0 6 12 18
SCALE AND ALL DIMENSIONS GIVEN IN INCHES

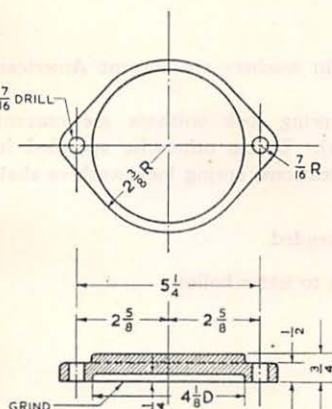
JUNCTION BOX BASE FOR 6 INCH MAST
FOR HEAVY LOADING - ASSEMBLY

AAR
SIG. SEC.
1477A

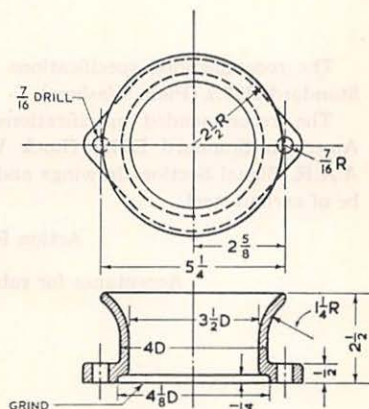
Bolts, nuts and threads shall be in accordance with Specifications for Bolts, Nuts and Threads, Manual Part 17.



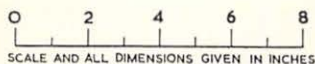
Cast iron shall be Class 20 in accordance with Specification for Gray Iron Castings, Manual Part 88. Bolts, nuts and threads shall be in accordance with Specifications for Bolts, Nuts and Threads, Manual Part 17. Painting shall be in accordance with Specification 120, Manual Part 110.



14791 CAP
CAST IRON



14792 OUTLET
CAST IRON



CAP AND OUTLET FOR 6 INCH JUNCTION BOX BASE
FOR HEAVY LOADING — DETAILS

AAR
SIG. SEC.
1479A

Cast iron shall be Class 20 in accordance with Specification for Gray Iron Castings, Manual Part 88. Painting shall be in accordance with Specification 120, Manual Part 110.

SPECIFICATIONS FOR PLAIN AND SPRING LOCK WASHERS

1953

The recommended specifications for plain washers are current American Standard B27.2 (Plain Washers).

The recommended specifications for spring lock washers are current American Standard B27.1 (Lock Washers). Unless otherwise specified in A.A.R. Signal Section drawings and specifications, spring lock washers shall be of carbon steel.

Action Recommended

Acceptance for submission to letter ballot.

COMMITTEE VII—MATERIALS RESEARCH

Personnel

E. A. Burgin, Chairman	
K. Chamberlain, Vice-Chairman	
F. E. Beutler	J. C. Hoffman
A. L. Essman	Curtis Kies
G. E. Goepfert	C. T. Marak
T. T. Hart	J. Mooney, Jr.
W. W. Hartzell	J. A. Moore
C. W. Hoffman	T. B. Thompson
W. K. Waltz	

Signal Section, A.A.R.:

The following outline of work has been assigned:

1. Revision of Manual.
2. Indexing signal literature.
3. Investigate and report on Vinyl paint systems as compared to conventional paint systems now in use.
4. Investigate and report on means for determining colors for target enamel covered in Specification 227, Manual Part 235, and prepare recommended colors.
5. Investigate and report on the use of automobile antifreeze compounds in spring switch buffers.
6. Investigate and report on wash primers.
7. Investigate and report on test installations of aluminum or newer or better steel alloys for relay and instrument housings.

The Committee submits for consideration, reports on the following subjects*:

5. Use of automobile antifreeze compounds in spring switch buffers.
6. Wash primers.
7. Test installations of aluminum or newer or better steel alloys for relay and instrument housings.

Disposition of 1952 Letter Ballot Subjects

The following subjects presented by Committee VII at the 1952 Annual Meeting were submitted to letter ballot and officially approved:

Specification 200-52—Aluminum Paint (Ready-to-Mix)—Now in Manual Part 62.

Specification 120-52—Painting—Now in Manual Part 110.

Specification 259-52—Aluminum Paint (Ready-Mixed)—Now in Manual Part 41.

Specification 13-52—Hard Fibre—Now in Manual Part 58.

* Suggestions or criticisms should be submitted in writing to the Chairman of the Committee on or before August 28, 1953.

Requisites for Fabricated Fibre Parts for Track Insulation—Now in Manual Part 178.

Specification 77-52—Impedance Bond Compound—Now in Manual Part 111.
Specifications for Various Types of Non-Ferrous Metals and Alloys—Now in Manual Part 220.

Specification 217-52—Impedance Bond Oil—Now in Manual Part 222.

Specification for Signal Colors Exclusive of Signal Glasses—Now in Manual Part 273.

WASH PRIMERS

A report on wash primers was presented at the 1952 Annual Meeting* covering the development and description of wash primers and a review of tests and experience in their use up to that time.

One signal equipment manufacturer has completed tests and is now using the two-package type of wash primer on all sheet metal relay cases and housings prior to the application of a zinc chromate-iron oxide primer and finish coats of aluminum paint.

A second signal equipment manufacturer is continuing tests of both two-package and one-package wash primers. While no final conclusions can be made at this time, their investigation indicates that wash primers are effective in retarding corrosion and rust creepage.

Action Recommended

Acceptance as information.

USE OF AUTOMOBILE ANTIFREEZE COMPOUNDS IN SPRING SWITCH BUFFERS

A survey on a number of railroads has been made to determine the use of automobile antifreeze compounds in spring switch buffers. These roads have reported successful use, over periods up to 8 years, of a certain automobile antifreeze compound as buffing agent in spring switch buffers in place of the oil covered by Specification 230, Manual Part 236.

The compound, mixed with water, provides a buffing agent which is non-freezing at temperatures encountered on railroads, thereby eliminating the necessity for seasonal attention and its consequent expense.

While the product is commonly referred to as an antifreeze compound, its use as a buffing agent is not confined to localities where low temperatures are experienced.

The only compound found by test to be satisfactory at the present time is "Zerex," an inhibited ethylene-glycol product made by DuPont, which is available at automobile service stations. Tests have shown that this product, as presently formulated, when used as a buffing agent, affords protection against

* A.A.R. Signal Section 1951 Proceedings, Vol. XLIX, pp. 212 and 390.

freezing and against rusting of the metal parts, has no adverse effects on gaskets, provides adequate lubrication, and the inhibited solution does not form particles which clog the ports of the buffer. Tests have shown that certain other trade-named compounds consisting of inhibited ethylene-glycol did not prove satisfactory as they tended to form particles which clogged the ports of the buffer.

A mixture is prepared by mixing three parts of Zerex and one part of water, by volume, and any fluid which may be lost by leakage should be replaced with a mixture of the same proportions. The mixture is suitable for use at temperatures above minus 55 deg. F. and any moisture which may condense becomes mixed with the main solution and is thus protected from freezing. It has very uniform viscosity and is better than Zerex used alone. While the mixture may be left in service for a number of years without changing, it is desirable to replace it at least every 2 years to insure cleanliness.

When the product is to be used in buffers which have previously been filled with oil, the manufacturer's recommendations for cleaning, to remove all traces of oil, should be followed. This is necessary to avoid the formation of sludge or other gummy material which may form from action between the antifreeze mixture and the oil.

One manufacturer is now furnishing the Zerex mixture with all new spring switch buffers. It is recommended that railroads desiring to use this compound refer the matter to the manufacturer of their buffers before so doing.

Action Recommended

Acceptance as information.

TEST INSTALLATIONS OF ALUMINUM OR NEWER OR BETTER STEEL ALLOYS FOR RELAY AND INSTRUMENT HOUSINGS

The following information supplements report appearing in A.A.R. Signal Section 1950 Proceedings, Vol. XLVIII, p. 307:

1. One large sheet steel relay house having sides and bottom fabricated of carbon sheet steel with roof of 18-8 stainless steel, all painted identically, was installed on an eastern railroad in November 1949 near a large chemical plant. Inspection made in May 1952 showed the roof to be in good condition with no signs of corrosion while the sides and bottom showed scattered rust spots. In November 1952 the paint was removed from the roof and no pitting or corrosion of the roof was found. The test is being continued with the roof in the unpainted condition.

2. The stainless steel case installed in a tunnel in May 1950, as previously reported, was fabricated entirely of 18-8 stainless steel using standard steel case design and tools and substantially the same thickness of sheet material. No paint was applied to the case. In a recent inspection, after 2 years of service, it was found to be covered with about $\frac{1}{4}$ inch of soot and incrustation from steam locomotives passing through the tunnel. Removal of a portion of this incrustation disclosed that the metal was pitted to some extent.

3. As previously reported, seven relay cases fabricated from aluminum alloys have been in service on an eastern railroad since 1948. They are at locations

where atmospheric conditions are strongly corrosive to steel and were installed to determine their corrosion-resistant properties and performance without paint protection. Since the cases were made primarily for a test of corrosion-resistant properties, they were fabricated using a standard steel case design and tools available wherever possible. Alloys 61S-T6 and 52S-H34 were selected as the most suitable aluminum alloys to meet service conditions. The aluminum alloy sheets were of the same thickness as the steel sheets normally used and were made of alloy 52S-H34 as it worked best in the available forming tools. Bar and round stock were alloy 61S-T6. Cable outlet and door handles were of cast aluminum. Bolts for outside use were of 18-8 stainless steel. A recent inspection of these aluminum cases shows that they are satisfactorily withstanding the atmospheric conditions at their respective locations without necessity for paint. Certain structural disadvantages resulting from the simple substitution of aluminum for steel have become apparent and should be taken into account if continuing superior corrosion resistance should encourage construction of aluminum cases in the future. The railroad reports that all cases show excessive wear of the aluminum rib where the steel dog of the door-latch assembly creates friction when closing the doors. It does not appear that it is possible to mount equipment, such as a test switch or telephone, on the outside without special reinforcing on the inside. It was necessary to use considerable care when erecting in order to prevent distortion of the base rails. It is doubtful if similar cases could be wired in a central point complete with all equipment and handled by truck or rail derrick without considerable inside blocking and provision of a lifting cradle to prevent distortion. These disadvantages can be overcome by proper design.

4. Life expectancy of these housings cannot be determined from present information.

Action Recommended

Acceptance as information.

COMMITTEE VIII—HIGHWAY GRADE CROSSING PROTECTION

Personnel

W. H. Stilwell, Chairman

H. T. Fleisher, Vice-Chairman

H. A. Appleby

P. H. Foley

A. M. Gilbert

S. B. Higginbottom

A. C. Jacobsen

J. E. K. Krylow

S. W. Law

B. F. McGowan

H. G. Morgan

P. H. Peters

W. F. Price

H. C. Sampson

E. J. Seybold

R. H. Smedley

W. R. Smylie

T. B. Thompson

J. L. Weatherby

L. S. Werthmuller

A. W. Wilson

H. D. Blake*

R. B. Elsworth*

H. A. Franklin*

L. McNally*

Signal Section, A.A.R.:

The following outline of work has been assigned:

1. Revision of Manual.
2. Indexing signal literature.
3. Report on noteworthy developments in highway grade crossing protection.
4. Investigate and report on the use of diffusing roundels in electric light units for highway crossing signals to provide a wider range of indication where a long view is not required.
5. Prepare location plans for highway grade crossing protection devices, collaborating with A.R.E.A. Committee 9.
6. Investigate and report on the durability and methods of maintenance of reflectorized signs.
7. Investigate and report on desirable uniform practice or practices concerning action to be taken by highway users when various types of highway grade crossing protection devices indicate the approach of trains.
8. Investigate and report on methods for preventing unnecessary operation of automatic highway grade crossing protection devices.
9. Investigate and report on types of roundels to meet specific physical conditions at individual highway grade crossings.
10. Investigate and report on the use of and desirability of eliminating illuminated stop sign from highway grade crossing signals.
11. Investigate and report on recommended practice for future installations of highway grade crossing protection on divided highways and one-way thoroughfares.

* Consulting Member.

The Committee submits for consideration reports on the following subjects**:

1. Revision and consolidation of Requisites for Automatic Gates, Requisites for Highway Grade Crossing Signals and Requisites for "No Right Turn" and "No Left Turn" Signals, Manual Parts 35, 148 and 224.

Revision of Instructions for Focusing and Aligning Railroad-Highway Grade Crossing Flashing Light Signal Units, Reflector Type, with Sealed Lamp Receptable, Manual Part 268.

4. Use of diffusing roundels in electric light units for highway crossing signals to provide a wider range of indication where a long view is not required.

5. A.A.R. Sig. Sec. 1730A to 1733A, inclusive.

7. Desirable uniform practice or practices concerning action to be taken by highway users when various types of railroad-highway grade crossing devices indicate the approach of trains.

Disposition of 1952 Letter Ballot Subjects

The following subjects presented by Committee VIII at the 1952 Annual Meeting were submitted to letter ballot and officially approved:

Specification 176-52—Automatic Highway Grade Crossing Signals and Devices—Now in Manual Part 149.

Signs Used in Connection with Manually Protected Railroad-Highway Grade Crossings—Now in Manual Part 269.

** Suggestions or criticisms should be submitted in writing to the Chairman of the Committee on or before August 28, 1953.

(Revision and Consolidation of Requisites for Automatic Gates, Requisites for Highway Grade Crossing Signals and Requisites for "No Right Turn" and "No Left Turn" Signals)
A.A.R. SIGNAL SECTION REQUISITES.

HIGHWAY GRADE CROSSING SIGNALS AND DEVICES

1953

1. Purpose.

(a) These requisites are for the purpose of setting forth the recommended general requirements for highway grade crossing signals and devices. They set forth specific detail requirements representing modern signal practice recommended for new installations and for replacement of existing installations when general renewal or replacement becomes desirable.

2. Signals and devices.

(a) Flashing light type signal shall conform to Drawing 1653, 1654, 1686 or 1688.

(b) Flashing light type signal with gate shall conform to Drawing 1462 or 1489.

(c) Wig-wag type signal shall conform to Drawing 1651 or 1652.

(d) "No Right Turn" or "No Left Turn" signal shall conform to Drawing 1488.

(e) Bell shall be in accordance with Specification 44, Manual Part 21.

3. Application.

(a) Either flashing light type signal, with or without gate, or wig-wag type signal may be used, but both types should not be used at the same crossing.

1. One signal shall be placed on each side of the track.

2. When a gate is used with a signal conforming to Drawing 1686 or 1688, it may be separately mounted on a pipe post or pedestal adjacent to the signal, preferably between the signal and the track.

(b) On highways adjacent to and approximately paralleling a railroad, which intersect or join another highway that crosses the railroad at grade, "No Right Turn" or "No Left Turn" signal may be used to supplement highway grade crossing signals which are located at the crossing.

(c) Bell may be used when required by public authority or special conditions.

4. Location.

(a) Flashing light type signal, with or without gate, or wig-wag type signal shall be placed preferably to the right of approaching highway traffic and conforming to Drawings 1730, 1731, 1732 and 1733. An additional signal may be used if it is determined to be impracticable to protect all highway traffic approaching the crossing from one direction with a single signal.

4. *Location.*—Continued.

(b) "No Right Turn" or "No Left Turn" signal shall be placed as close to the intersection as practicable.

(c) Bell should be mounted preferably on the mast supporting the crossing signal, with the face of the gong parallel to the highway.

5. *Operating requirements.*

(a) Flashing light type electric light units shall be in accordance with Specification 190, Manual Part 166, or Specification 232, Manual Part 244, and shall be arranged to shine in both directions along the highway.

1. Electric lamps shall flash alternately. The number of flashes per minute of each electric lamp shall be 30 minimum, 45 maximum.

2. Electric lamps shall be illuminated approximately the same length of time. Total illuminated time of each pair of electric lamps shall be practically the entire operating time.

(b) Wig-wag type electric light units shall shine in both directions along the highway.

1. Lenses or roundels shall be highway crossing red 5 in. diameter minimum and in accordance with Specification 69, Manual Part 136.

2. Electric light unit, when disc is suspended vertically, shall have a range at night of 1,500 ft. through a total angle of not less than 20 deg. when a 10 watt lamp rated at 1,000 hours is burned at rated voltage.

3. Movement from one extreme to the other and back constitutes one cycle of a wig-wag signal. The number of cycles per minute shall be 30 minimum, 45 maximum.

(c) Gate arm, when in the raised position, shall not obstruct or interfere with highway traffic.

1. Electric motor mechanism shall be in accordance with Specification 199, Manual Part 194.

2. Gate arm shall conform to Drawing 1491, 1492, 1493 or 1494.

3. Electric light units on gate arm shall be in accordance with Specification 236, Manual Part 263.

(d) Illuminated indicators and signs shall be in accordance with Specification 231, Manual Part 237.

(e) Size and range of bell shall be determined by local conditions.

(f) Controls for operation of highway grade crossing signals and devices shall be in accordance with Requisites for Control of Automatic Highway Grade Crossing Signals and Devices, Manual Part 274.

(g) Installation of highway grade crossing signals and devices shall be in accordance with Specification 176, Manual Part 149.

6. *Painting.*

(a) Painting shall be in accordance with Specification 120, Manual Part 110. All metal parts which do not function as hoods or backgrounds for signals employing lights shall be given a finishing coat of white or aluminum when installed.

7. *Highway marking.*

(a) At a railroad-highway grade crossing where flashing light type signals with gates are installed, the highway traffic lanes in the vicinity of the crossing should be distinctly marked to separate directional highway traffic in the same manner as is prescribed by State or local authorities for "No Passing" zones.

Action Recommended

Acceptance for submission to letter ballot superseding subject-matter in the Manual.

Subject-matter to be Superseded

Requisites for Automatic Gates, Manual Part 35.

Requisites for Highway Grade Crossing Signals, Manual Part 148.

Requisites for "No Right Turn" and "No Left Turn" Signals,
Manual Part 224.

DESIRABLE UNIFORM PRACTICE OR PRACTICES CONCERNING
ACTION TO BE TAKEN BY HIGHWAY USERS WHEN VARIOUS
TYPES OF RAILROAD-HIGHWAY GRADE CROSSING
DEVICES INDICATE THE APPROACH OF TRAINS

In order to progress this matter it was deemed advisable to determine, among other things, what statutes, rules or regulations are in effect in the several States as concerning action to be taken by vehicle drivers when a protective device indicates the approach of a train. Such information was obtained and has been summarized to show the laws, rules and regulations of States pertaining to the behavior of motor vehicle traffic at railroad-highway grade crossings. The headings of the summary, Table I, have reference to the several provisions of Act V, Article 13, of Uniform Act Regulating Traffic on Highways quoted below. These provisions have for the most part been used by many of the States as a basis for legislation governing highway traffic at these locations.

ACT V, ARTICLE 13, UNIFORM ACT REGULATING TRAFFIC ON HIGHWAYS,
AS REVISED AND APPROVED BY THE NATIONAL COMMITTEE ON UNIFORM
TRAFFIC LAWS AND ORDINANCES, 1948

"Special Stops Required

"Sec. 104. OBEDIENCE TO SIGNAL INDICATING APPROACH OF TRAIN.

—(a) Whenever any person driving a vehicle approaches a railroad grade crossing under any of the circumstances stated in this section, the driver of such vehicle shall stop within 50 feet but not less than 15 feet from the nearest rail of such railroad, and shall not proceed until he can do so safely. The foregoing requirements shall apply when:

"1. A clearly visible electric or mechanical signal device gives warning of the immediate approach of a railroad train;

"2. A crossing gate is lowered or when a human flagman gives or continues to give a signal of the approach or passage of a railroad train;

"3. A railroad train approaching within approximately 1,500 feet of the highway crossing emits a signal audible from such distance and such railroad train, by reason of its speed or nearness to such crossing, is in immediate hazard;

"4. An approaching railroad train is plainly visible and is in hazardous proximity to such crossing.

"(b) No person shall drive any vehicle through, around, or under any crossing gate or barrier at a railroad crossing while such gate or barrier is closed or is being opened or closed.

"Sec. 105. ALL VEHICLES MUST STOP AT CERTAIN RAILROAD GRADE CROSSINGS—The (State highway commission) and local authorities with the approval of the (State highway commission) are hereby authorized to designate particularly dangerous highway grade crossings of railroads and to erect stop signs thereat. When such stop signs are erected the driver of any vehicle shall stop within 50 feet but not less than 15 feet from the nearest rail of such railroad and shall proceed only upon exercising due care.

"Sec. 106. CERTAIN VEHICLES MUST STOP AT ALL RAILROAD GRADE CROSSINGS.—(a) The driver of any motor vehicle carrying passengers for hire, or of any school bus carrying any school child, or of any vehicle carrying explosive substances or flammable liquids as a cargo or part of a cargo, before crossing at grade any track or tracks of a railroad, shall stop such vehicle within 50 feet but not less than 15 feet from the nearest rail of such railroad and while so stopped shall listen and look in both directions along such track for any approaching train, and for signals indicating the approach of a train, except as hereinafter provided and shall not proceed until he can do so safely. After stopping as required herein and upon proceeding when it is safe to do so the driver of any said vehicle shall cross only in such gear of the vehicle that there will be no necessity for changing gears while traversing such crossing and the driver shall not shift gears while crossing the track or tracks.

"(b) No stop need be made at any such crossing where a police officer or a traffic-control signal directs traffic to proceed.

"(c) This section shall not apply at street-railway grade crossings within a business or residence district.

"Sec. 107. MOVING HEAVY EQUIPMENT AT RAILROAD GRADE CROSSINGS.—(a) No person shall operate or move any crawler-type tractor, steam shovel, derrick, roller, or any equipment or structure having a normal operating speed of 10 or less miles per hour or a vertical body or load clearance of less than one-half inch per foot of the distance between any two adjacent axles or in any event of less than 9 inches, measured above the level surface of a roadway, upon or across any tracks at a railroad grade crossing without first complying with this section.

"(b) Notice of any such intended crossing shall be given to a station agent of such railroad and a reasonable time be given to such railroad to provide proper protection at such crossing.

"(c) Before making any such crossing the person operating or moving any such vehicle or equipment shall first stop the same not less than 15 feet nor more than 50 feet from the nearest rail of such railroad and while so stopped shall listen and look in both directions along such track for any approaching train and for signals indicating the approach of a train, and shall not proceed until the crossing can be made safely.

"(d) No such crossing shall be made when warning is given by automatic signal or crossing gates or a flagman or otherwise of the immediate approach of a railroad train or car. If a flagman is provided by the railroad, movement over the crossing shall be under his direction."

TABLE I
Summary of Laws of States Pertaining to Behavior of Motor Vehicle Traffic at Railroad-Highway Grade Crossings

State	All vehicles must stop at railroad grade crossing when warned by an electric or mechanical device or human flagman of approaching train	At particularly dangerous grade crossing marked "Stop" by state every vehicle must:	Statutes provide that motor vehicles must:	Types of vehicles which must stop at all railroad-highway grade crossings			
				Passenger buses	School buses	Carriers of explosives and inflammables	Cumbersome slow moving equipment
Ala.	Yes—Penalty	Yes	No	Yes(a)	Yes(a)	Yes(a)	No
Ariz.	Yes—Penalty	Yes	No	Yes	Yes	Yes	Yes
Ark.	Yes	Yes	No	Yes	Yes	Yes	Yes
Calif.	Yes	No	No	Yes	Yes	Yes	No
Colo.	Yes	Yes	No	Yes	Yes	Yes	Yes
Conn.	No	No	No	Yes	Yes	Yes	No
Del.	Yes—Penalty	No	No	No	No	No	No
Fla.	No	Yes	No	Yes(a)	Yes(a)	Yes(a)	No
Ga.	No—Yes(d)	No	No	Yes	No	No	No
Idaho	Yes	Yes	No	No	Yes	No	No
Ill.	Yes	No	No	Yes	Yes	Yes	Yes
Ind.	Yes—Penalty	Yes	No	Yes	Yes	Yes	Yes
Iowa	Yes	Yes	No	Yes	Yes	Yes	Yes
Kans.	Yes	Yes	No	Yes	Yes	Yes	Yes
Ky.	Yes	Yes	No	Yes	Yes	No	No
La.	Yes(b)	(b)	No	Yes	Yes	Yes	(b)
Maine	Yes—Penalty	No	Yes	Yes	Yes	Yes	No
Md.	Yes—Penalty	No	No	Yes	Yes	Yes	No
Mass.	No	No	Yes	Yes	Yes	Yes	No
Mich.	Yes	Yes	No	Yes	Yes	Yes	No

Minn.	Yes	Yes	No	Yes	Yes	Yes	Yes
Miss.	Yes	Yes	No	Yes	Yes	Yes	Yes
Mo.	No	No	No	Yes	Yes	Yes	No
Mont.	No	No	No	Yes	No	Yes	No
Nebr.	Yes	No	No	Yes	Yes	Yes	No
Nev.	No	No	No	No	Yes	Yes	No
N.H.	No	No	Yes	Yes	Yes	Yes	No
N.J.	Yes	No	No	Yes(c)	Yes	Yes	Yes
N.Mex.	Yes	Yes	No	Yes	Yes	Yes	No
N.Y.	Yes	No	No	Yes	Yes	Yes	No
N.C.	Yes	Yes	No	Yes	Yes	No	No
N.Dak.	Yes	Yes	No	Yes(d)	No	No	No
Ohio	Yes	Yes	No	Yes	Yes	Yes	Yes
Okla.	(e)	No	No	Yes	Yes	Yes	No
Oreg.	Yes	Yes	No	Yes	Yes	Yes	Yes
Pa.	Yes	No	No	Yes	Yes	Yes	No
R.I.	Yes	Yes	No	Yes	Yes	Yes	Yes
S.C.	No	No	Yes(f)	Yes(d)	Yes	Yes(d)	No
S.Dak.	Yes	Yes	No	Yes	Yes	Yes	No
Tenn.	Yes	Yes	No	Yes(d)	No	Yes(d)	No
Tex.	Yes	Yes	No	Yes	Yes	(g)	Yes
Utah	Yes	Yes	No	Yes	Yes	Yes	Yes
Vt.	Yes—Penalty	No	Yes	Yes	Yes	No	No
Va.	Yes	No	Yes	No	Yes	No	No
Wash.	Yes	Yes	No	Yes	Yes	Yes	No
W.Va.	No	No	Yes	No	Yes	Yes	Yes
Wis.	Yes	Yes	No	Yes	Yes	Yes(h)	No
Wyo.	Yes	Yes	No	Yes	Yes	Yes	No

See notes on page 146.

TABLE I—Continued

- Notes: (a) Rule or regulation of state regulatory body.
(b) *All* vehicles are required to stop at *all* railroad grade crossings.
(c) Any omnibus designed for carrying more than six passengers.
(d) Includes all vehicles operated by any motor transportation company (passenger or freight). Public Service Commission rule.
(e) Not required to stop but required to reduce speed so that stop may be made if necessary.
(f) Only vehicles of carriers regulated by Public Service Commission required to slow down at all railroad grade crossings.
(g) Required to reduce speed to 20 miles per hour, and not to cross track unless it can be done safely.
(h) Inflammable liquids in quantities of 100 gallons.

*Information Relating to Canadian Provinces**Ottawa*

Board of Transport Commissioners for Canada—Ottawa.

Such matters do not come under jurisdiction of the Board. They are administered by Individual Provincial Departments of Highways.

British Columbia

Subsection 2 of Section 60 of the "Motor Vehicle Act"—

"Every person driving or operating a motor vehicle upon any highway approaching a grade crossing of an intersecting railway at which is erected an automatic electric bell and warning device of the wig-wag or flashing light type shall, if the bell is ringing or the warning device is in operation, stop the motor-vehicle and shall not enter upon or cross the railway while the bell is ringing or the warning device is in operation."

Manitoba

Manitoba Highway Traffic Act—

"It is mandatory for the driver of a passenger bus, a school van, or of a motor vehicle carrying any bulk shipment of inflammable liquid, such as coal oil, distillate or gasoline, to bring his vehicle to a stop at all railroad crossings and not to traverse the crossing until it is safe to do so."

"Under the Manitoba Highway Traffic Act all vehicles approaching a level railway crossing shall stop when a clearly visible or audible signal gives warning of the immediate approach of a train."

Nova Scotia

Section 21 of the Regulations of the Motor Carrier Act—

"The operator of a public vehicle as defined above, shall before crossing a track or tracks of any railway at grade shall bring his vehicle to a full stop, proceeding over it with the vehicle in low gear when satisfied that no cars or trains are approaching."

Section 113 of the Motor Vehicle Act—

"Whenever any person driving a vehicle approaches a highway and railway grade crossing and a clearly visible or positive signal gives warning of the immediate approach of a railway engine, train or car, it shall be an offense for the driver of the vehicle to fail to stop the vehicle before traversing such grade crossing."

"The expression 'Public Vehicle' means a motor vehicle operated by or on behalf of any person carrying on, upon any highway, the business of a public carrier of passengers, or passengers and freight, for gain."

Ontario

The Highway Traffic Act—Revised Statutes of Ontario, 1950, as amended in 1951, Chapter 34 states: "No motor vehicle shall be operated at a greater rate of speed than **** (c) twenty miles per hour over a level railway crossing ****."

New Brunswick

The New Brunswick Motor Vehicle Act, Section 42, Subsection 11-a provides that a commercial vehicle carrying gasoline or other fuel oil in bulk shall bring the vehicle to a full stop and shall not proceed across a railway track until it is ascertained that no train is approaching.

Section 15 of the Motor Carrier Board Regulations provides that at railroad grade crossings where railway gates and operating personnel are not provided that a public motor bus or a school bus shall be brought to a complete stop not less than 10 feet or more than 50 feet from nearest rail of a railroad track; also that the driver shall open the front exit door of the bus after stop is made and make certain that it is safe to cross the tracks,—the door to remain open until crossing is made; also the vehicle shall be driven across the tracks in first gear.

Quebec

The Motor Vehicle Act of this Province provides for a speed not in excess of 20 miles per hour at level railway crossings.

Saskatchewan

Section 131, Chapter 94, of an Act respecting the operation of vehicles—

"(1) The driver of a vehicle shall at every place where a stop sign is erected bring the vehicle to a dead stop and shall not proceed until it is safe to do so.

"(2) The driver of a vehicle approaching a level railway crossing shall, when any signal man, any automatic signal or other safety device indicates the approach of a train, bring the vehicle to a dead stop, and shall not proceed until the signal man, automatic signal or device indicates that it is safe to do so.

"(3) The driver of a vehicle shall, before proceeding over a level railway crossing on the approach to which a sign indicating danger, or stop sign, is erected, whether or not a train can be seen or heard approaching the crossing, bring his vehicle to a dead stop at the danger or stop sign and shall not proceed until it is safe to do so.

"(4) The driver of a vehicle, when transporting gasoline or any other fuel petroleum product, or liquid which is inflammable or explosive, other than in the fuel tank of a motor vehicle, shall, before proceeding over a level railway crossing, whether or not a train can be seen or heard approaching the crossing, bring the vehicle to a dead stop and shall not proceed until it is safe to do so.

"(5) The driver of a public service vehicle used for the transportation of passengers shall, before proceeding over a level crossing, whether or not a train can be seen or heard approaching the crossing, bring the vehicle to a dead stop and shall not proceed until it is safe to do so."

Newfoundland

Regulation 53 of the Newfoundland Highway Traffic Act, 1951—

"53. The operator of a public service vehicle shall before crossing a track or tracks of any railway bring his vehicle to a full stop and then proceed over the crossing with the vehicle in low gear when he is satisfied that no cars or trains are approaching."

"Public service vehicle" means a vehicle designed or used for carrying passengers for hire or reward at separate fares, but does not include a motor vehicle designed to carry less than seven passengers in addition to the driver."

Prince Edward Island

Section 44—Chapter 73, of The Highway Traffic Act, 1951—

"(1) Whenever upon a highway a vehicle approaches a level railway crossing and a clearly visible or audible signal gives warning of the immediate approach of a railway engine, train or car, the driver shall bring the vehicle to a stop before traversing the crossing and shall not proceed until it is safe to do so.

"(2) Any person acting under the authority of the Minister of Public Works and Highways may erect a 'Stop' sign at an intersection or level railway crossing and wherever such 'Stop' sign has been erected the driver of every vehicle shall bring it to a stop before traversing the crossing or intersection and shall not proceed until it is safe to do so.

"(3) Every 'Stop' sign erected under the provisions of this Section shall be illuminated at night or so placed as to be illuminated by the lights of an approaching vehicle or by street lights.

"(4) The driver of a motor vehicle approaching a level railway crossing, whether or not such crossing is provided with a visible or audible signal giving warning of the immediate approach of a railway engine, train or car, shall slow down or bring the vehicle to a stop before traversing the crossing and shall not proceed until it is safe to do so."

General

The railroad-highway grade crossing problem is an important one, witnessed by the fact that in 1951 collisions between trains and vehicles at grade crossings in the United States resulted in 1,578 deaths and 4,335 injuries to persons. Eliminating non-collision and collisions with fixed objects from the total for all types of highway accidents, the train vehicle type accidents rank third in the list, the first two being collisions between vehicles and vehicles with pedestrians. Consideration of accident prevention programs or any solutions for reduction in number of such accidents, therefore, appears to be justified. It is axiomatic, however, that drivers of vehicles must share the responsibility for safe movement through these intersections for it is not practicable for the railroads to educate vehicle drivers and it is certainly not practicable for railroads to police them.

There are many phases to this problem but the concern of the Committee in handling this assignment is with reference to action to be taken by the vehicle driver when protective devices indicate the approach of a train. It will be noted that at least 37 of the states have provided by statute that the driver of a vehicle shall stop and not proceed until he can do so safely when a mechanical, an electrically controlled signal device, a human flagman or a gate arm lowered across the roadway give warning of the approach or passage of a train. Such statutory provisions are commendable and in general seem satisfactory. It would appear that those states which have not yet adopted substantially the provisions of Act V, Article 13, of the Uniform Act Regulating Traffic on Highways should give consideration to the necessity of doing so.

Substantial uniformity regarding statutes, rules and regulations as applying

to the behavior of traffic at these intersections, is just as necessary as uniformity of crossing signal standards. The A.A.R. standardization for types of signals has made it possible for such signals to mean the same to all highway users. Since highway vehicular traffic has broadened within recent years from purely local to a national, or even international scope, it becomes more important that uniformity prevail in requirements relating to action to be taken by vehicle drivers at such intersections. Uniform statutory directives as to highway traffic movements could make it possible to obtain uniform application and enforcement of such regulations. The replacement of diverse and conflicting highway traffic rules and regulations by uniform directives as to such movements should result in identical understanding by motorists wherever they may be driving.

It is obvious, however, that the adoption of uniform statutes, rules or regulations alone cannot solve the problem. There must be a uniform enforcement of the provisions of requirements, including some penalty provision where the requirements are not obeyed. Until there is enforcement by duly constituted authorities having police powers little benefit can be expected to accrue from such requirements as now exist. One instance can be cited where, after signals had been provided at 28 city street intersections with railroad tracks, the city adopted an ordinance making it a misdemeanor for the operator of a motor vehicle not to stop when signals indicated the approach of a train and to proceed when the way was seen or known to be clear. The police make an occasional check and a few arrests with the result that over a period of 20 years the obedience has been excellent and only two minor accidents have occurred.

The reasons normally advanced in one of our states by police and patrol authorities, for not requiring obedience to statutory requirements at railroad-highway grade crossings are:

1. That it is the problem of the railroad company.
2. That the protective signals and devices operate unnecessarily, or where no train is approaching, or where there is no immediate hazard.

The first assumption is erroneous, because the railroad company is not in a position to enforce obedience to the warning indications of these devices. The problem of highway safety in general is a public one and is generally accepted as such. It seems quite inconsistent that police and patrol authorities assume jurisdiction over highway traffic at all other points and avoid responsibility to enforce regulations at railroad-highway grade crossings.

Regarding the second reason advanced for non-enforcement, most of the locations at which unnecessary operation of signals are found were installed some years ago. The modernization of these older installations so as to provide reasonably uniform warning time regardless of train speeds, station stops and switching movements, is very desirable. It is recognized that it may be difficult for the railroads to justify the expense of such revision of older installations but failure to do so invites a certain amount of criticism from the general public. The unnecessary operation of signals leads to a tendency on the part of the public to feel that the protection is not reliable. Recent installations generally are so controlled that the warning given to highway traffic means that the approach of a train is imminent. It is believed that mandatory stops by highway vehicles would be easier to enforce and that the attitude of the public toward the warning would improve if there is an improved uniformity of the controls of all such protection.

Conclusions

1. The first requirement for uniform action by highway users who approach railroad-highway grade crossing signals and devices that are operating to indicate the approach of a train should be to "STOP" and not proceed until they can do so safely.

2. This requirement should be adopted by all States and Provinces.

3. All States and Provinces should provide for enforcement and provide for a penalty to be assessed against the driver for not complying with such requirement.

4. This matter should be progressed through proper channels to street and highway authorities throughout the country; action should be urged in the matter of enforcement of statutory or other requirements where same now exist; and such States as do not now have such requirements should be urged to adopt provisions similar to those contained in Act V, Article 13, of the Uniform Act Regulating Traffic on Highways.

Information

A.A.R. Safety Section Circular No. S-1294, dated May 13, 1952, entitled "Report of Committee on Prevention of Highway Crossing Accidents" contains similar information on the subject-matter of this report, particularly as concerning manners of accomplishment of objectives.

Action Recommended

Acceptance as information.

USE OF DIFFUSING ROUNDELS IN ELECTRIC LIGHT UNITS
FOR HIGHWAY CROSSING SIGNALS TO PROVIDE A
WIDER RANGE OF INDICATION WHERE A LONG
VIEW IS NOT REQUIRED

A group of curves showing the horizontal light distribution patterns of 11 types of roundels were presented at the 1952 Annual Meeting*.

Vertical light distribution patterns covering this same group of roundels have been plotted from field observations and 24 curves showing these patterns are presented herein. (See pages 153-176.)

Apparatus, voltage at lamps, and alignment of units used to obtain these vertical patterns are the same as in the 1952 report. An additional pair of lights on the same mast, at a center-line height of 15 feet 8 inches above the foundation top were used to obtain the vertical light distribution of these roundels at cantilever signal height.

It was observed that the horizontal distribution of these roundels at cantilever height remains unchanged from that previously observed at the height of 7 feet 10 inches.

A 30-degree horizontal spreadlight with 15-degree downward deflection roundel was placed in one light unit at each height and retained there for use as a standard of comparison. Test roundels of each of the other 10 types were then alternately placed in the other light unit of each pair and observations were made by walking along the reference line at the center of the beam toward and away from the mast until a point of separation between usable and unusable light was observed. Other points along this line of separation below average eye-level were then observed. These points formed a straight line below-eye-level, therefore, it was considered practical to assume a straight line curve above eye-level.

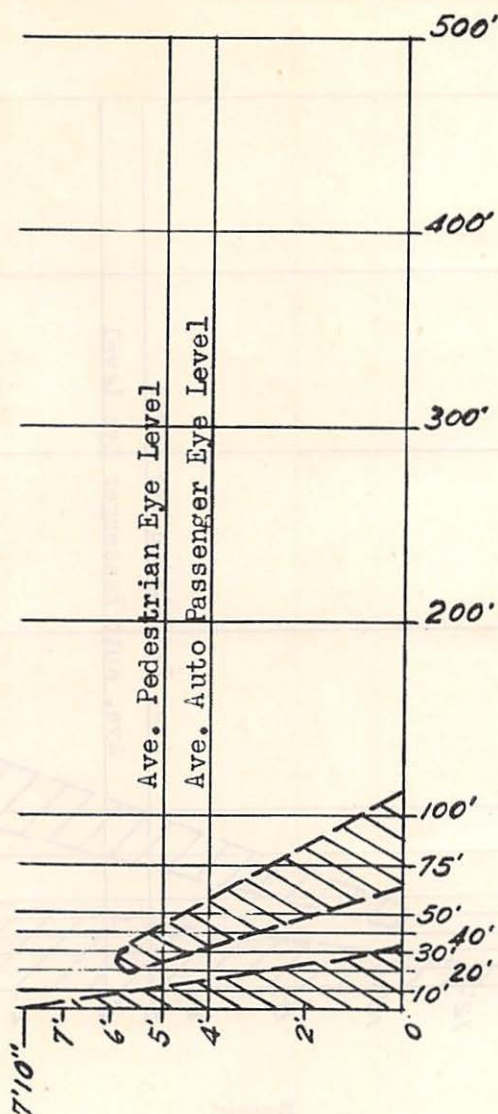
The results of these observations were plotted graphically in the 24 curves presented herewith. Curves with subscript A were observed with the center line of the test roundel 7 feet 10 inches above the foundation top, and curves with subscripts B with the center line 15 feet 8 inches above the foundation top. Curves 4C and 4D were observed with the light beam aligned 5 degrees above the horizontal.

Shading on these curves denotes unusable light areas, and the unshaded portions denote areas of light of sufficient intensity for warning to highway traffic at railroad grade crossings.

Action Recommended

Acceptance as information.

* A.A.R. Signal Section 1951 Proceedings, Vol. XLIX, pp. 266 and 376.



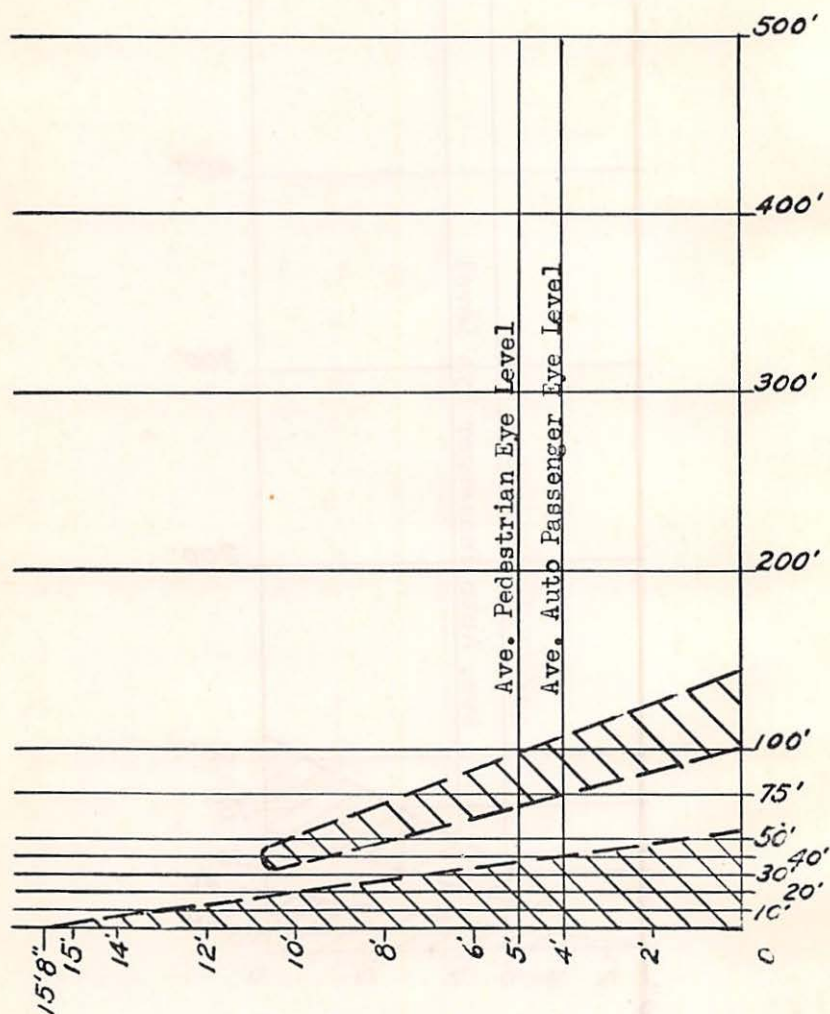
Roundel

A.A.R. Signal Section Specification 190, Manual Part 166,
section 8-b-1

30-degree horizontal spreadlight with 15-degree downward deflection
Kopp #4564

Shading denotes non-usable light area

CURVE 1A



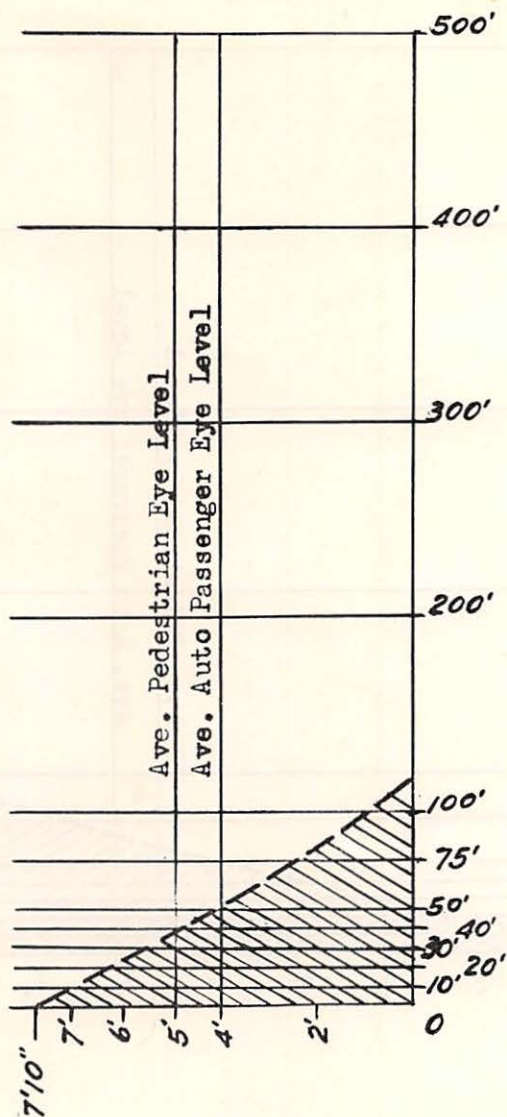
Roundel

A.A.R. Signal Section Specification 190, Manual Part 166,
 section 8-b-1

30-degree horizontal spreadlight with 15-degree downward deflection
 Kopp #4564

Shading denotes non-usable light area

CURVE 1B



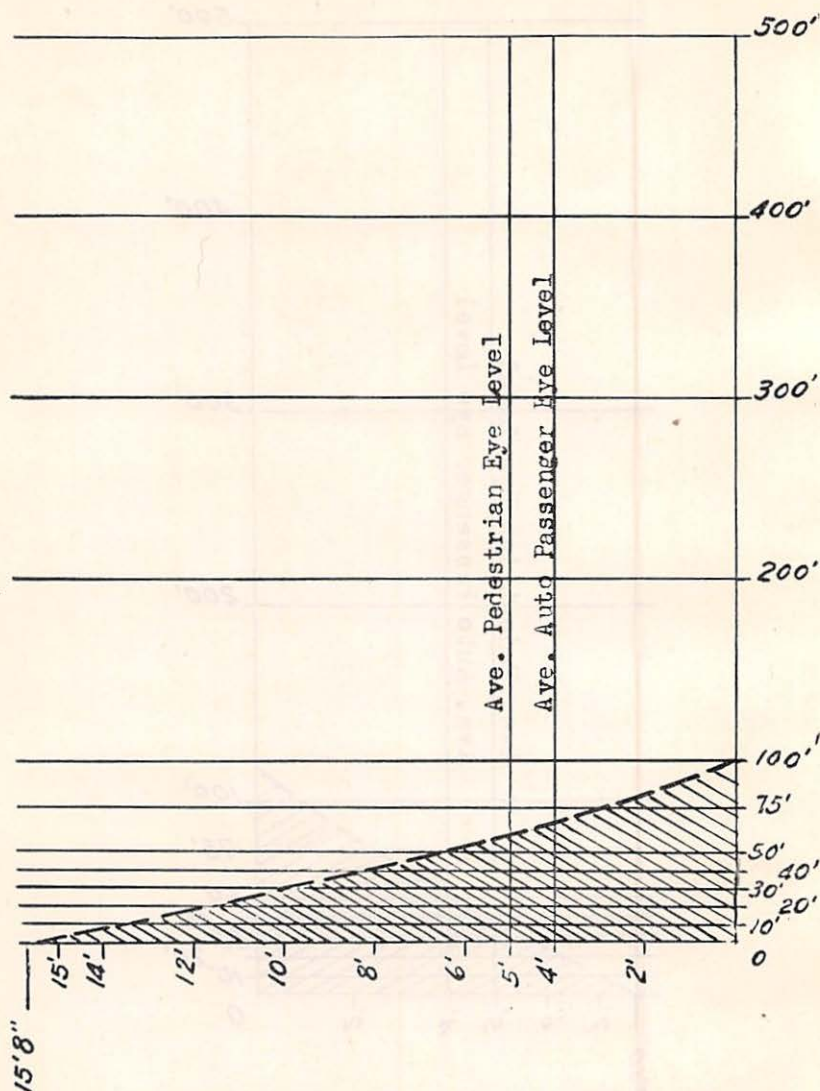
Roundel

A.A.R. Signal Section Specification 190, Manual Part 166,
section 8-b-2

70-degree horizontal spreadlight

Shading denotes non-usable light area

CURVE 2A



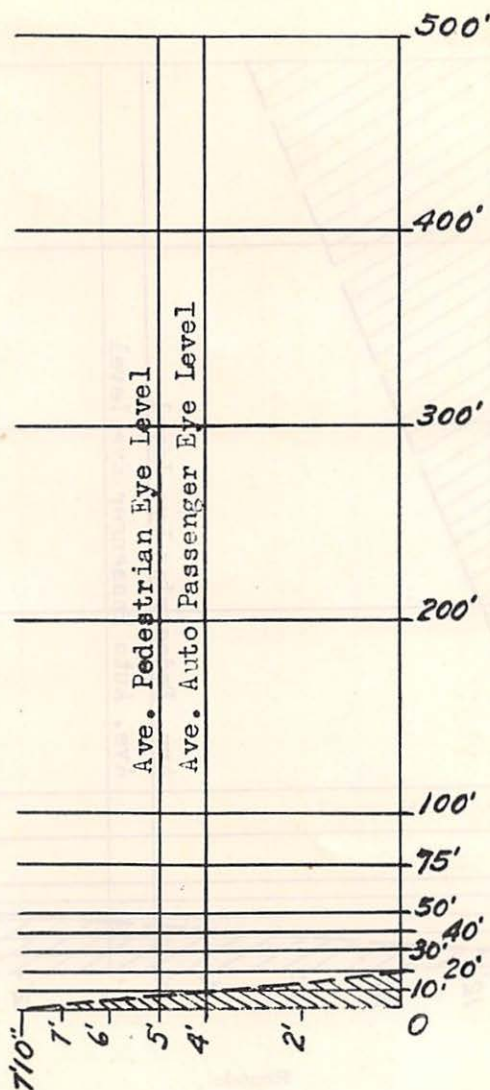
Roundel

A.A.R. Signal Section Specification 190, Manual Part 166,
section 8-b-2

70-degree horizontal spreadlight

Shading denotes non-usable light area

CURVE 2B

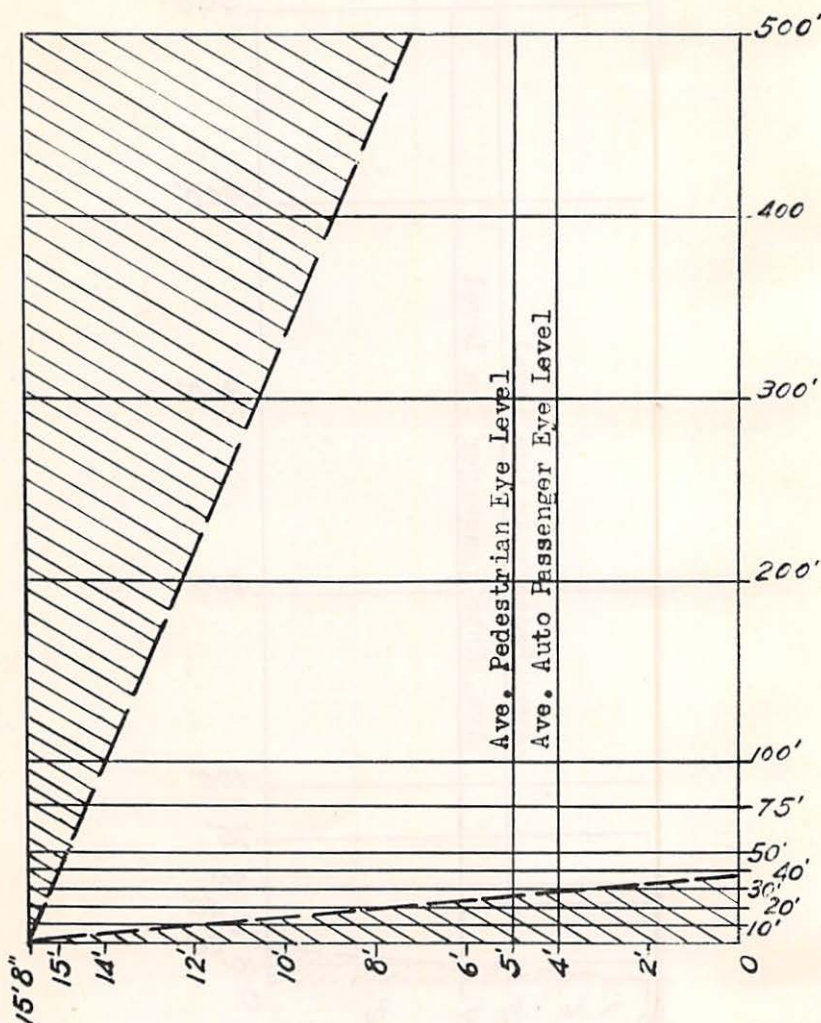
Roundel

A.A.R. Signal Section Specification 190, Manual Part 166,
section 8-b-3

20-degree horizontal spreadlight with 32-degree downward deflection
Corning #55472

Shading denotes non-usable light area

CURVE 3A

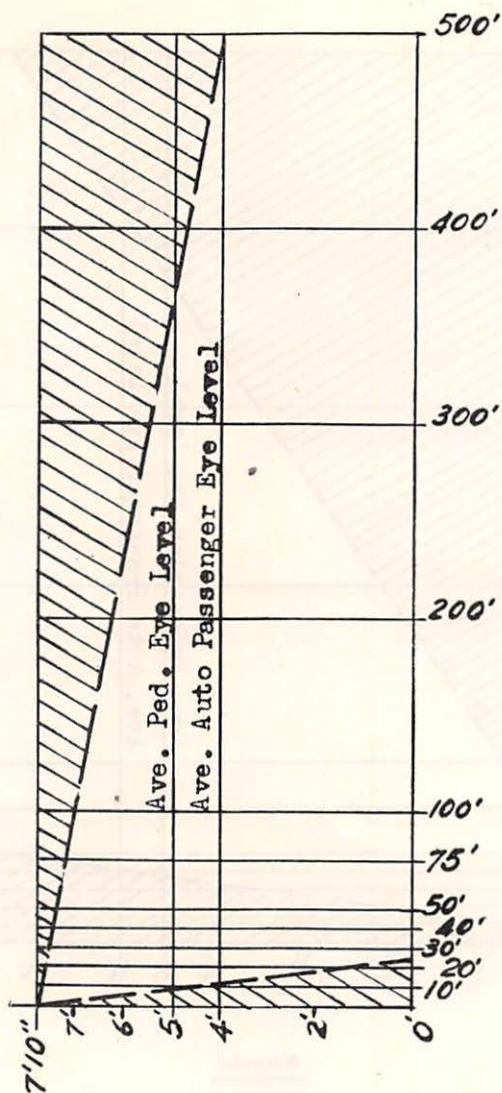
Roundel

A.A.R. Signal Section Specification 190, Manual Part 166,
section 8-b-3

20-degree horizontal spreadlight with 32-degree downward deflection
Corning #55472

Shading denotes non-usable light area

CURVE 3B



Roundel

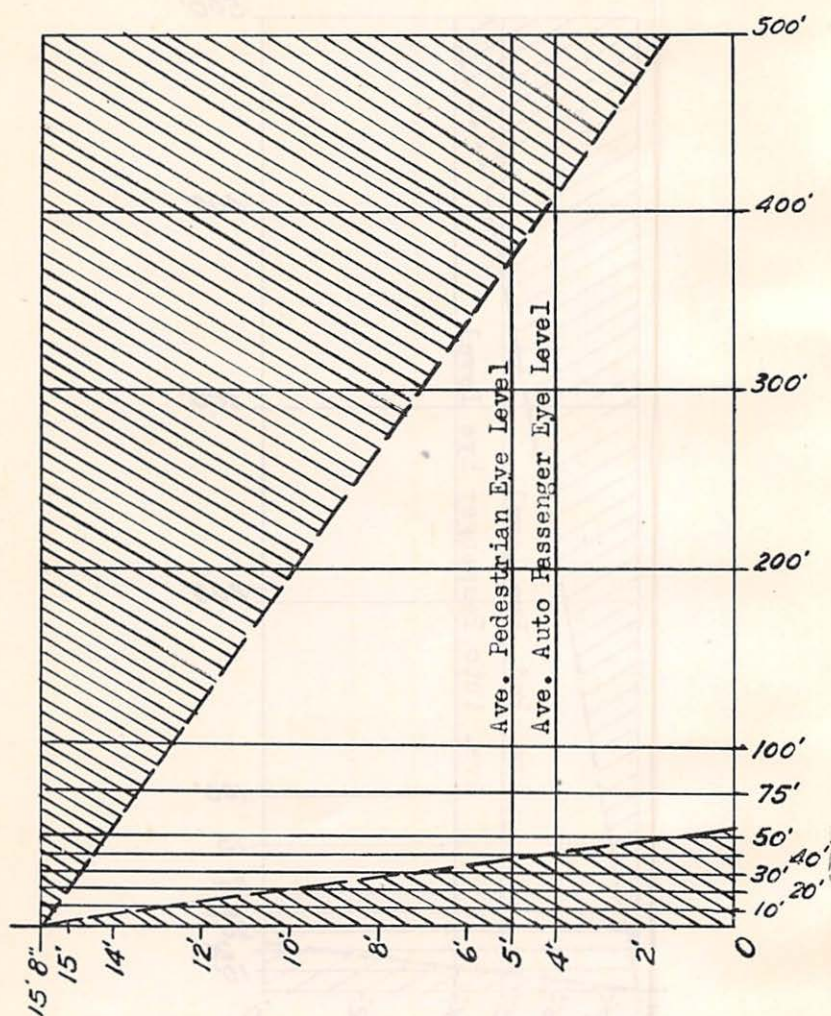
A.A.R. Signal Section Specification 190, Manual Part 166,
section 8-b-4

Diffusing deflection

Kopp #27

Shading denotes non-usable light area

CURVE 4A



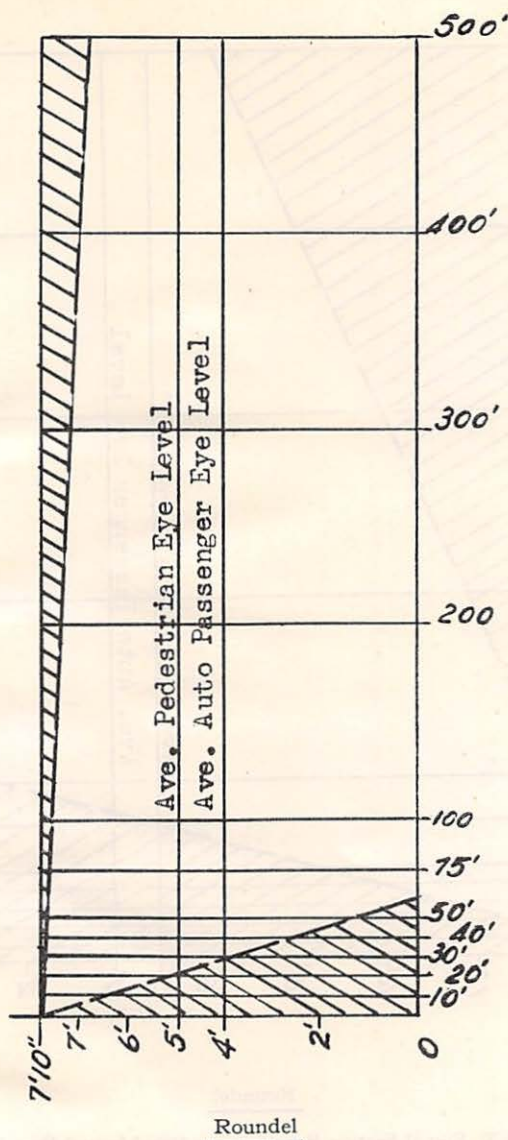
Roundel

A.A.R. Signal Section Specification 190, Manual Part 166,
 section 8-b-4

Diffusing deflection
 Kopp #27

Shading denotes non-usable light area

CURVE 4B



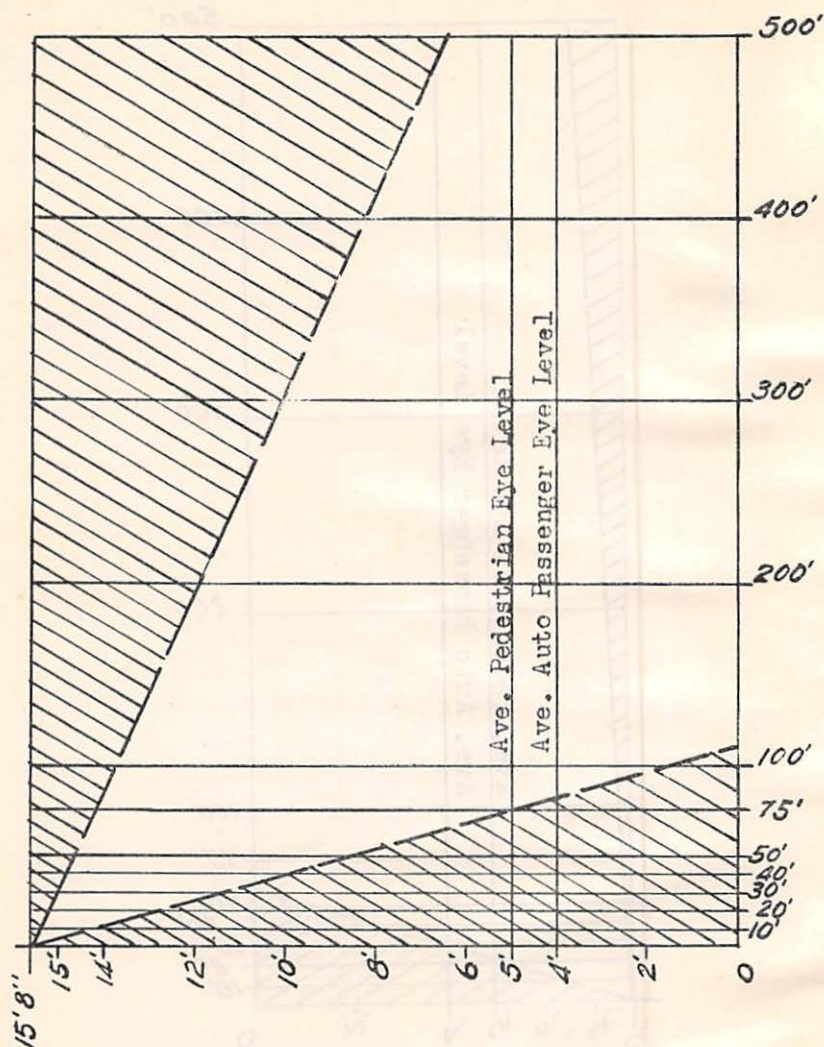
A.A.R. Signal Section Specification 190, Manual Part 166,
section 8-b-4

Diffusing deflection

Kopp #27

Shading denotes non-usable light area

CURVE 4C

Roundel

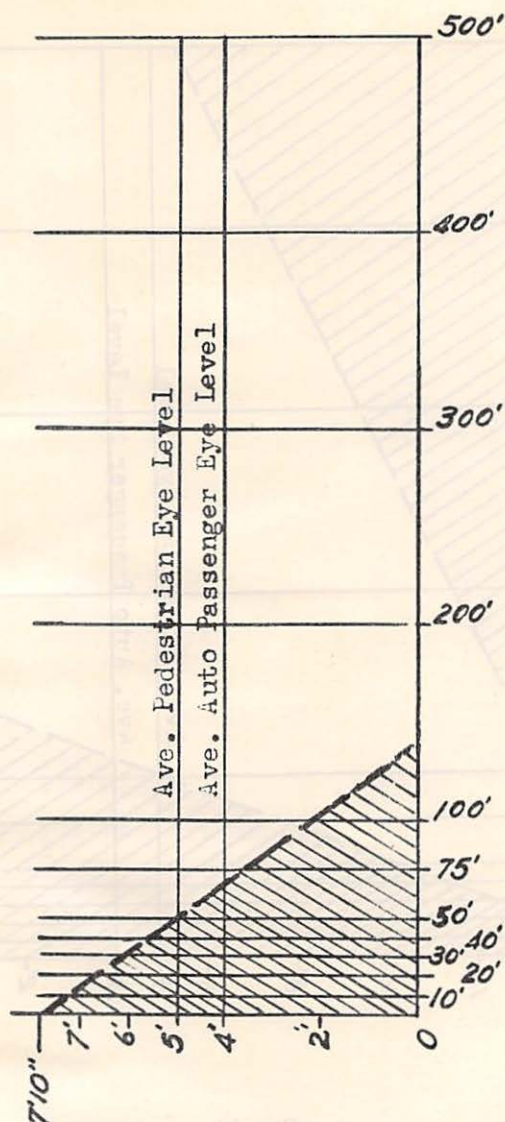
A.A.R. Signal Section Specification 190, Manual Part 166,
section 8-b-4

Diffusing deflection

Kopp #27

Shading denotes non-usable light area

CURVE 4D



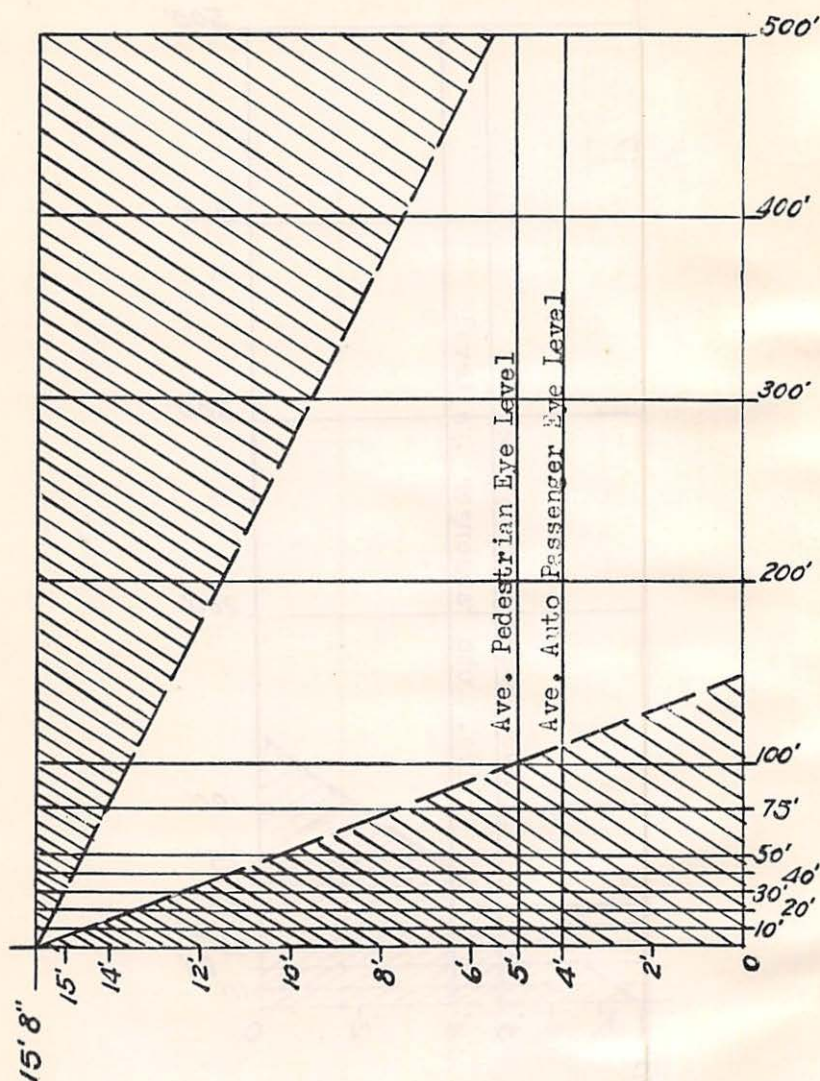
Roundel

A.A.R. Signal Section Specification 190, Manual Part 166,
alternate requisites section R-8-b

30-degree horizontal spreadlight

Shading denotes non-usable light area

CURVE 5A



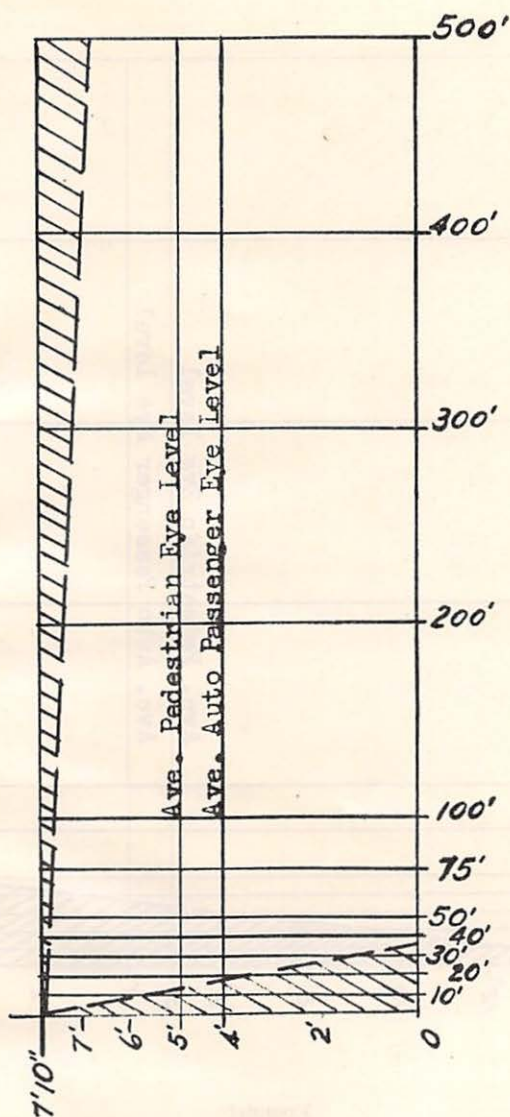
Roundel

A.A.R. Signal Section Specification 190, Manual Part 166,
 alternate requisites section R-8-b

30-degree horizontal spreadlight

Shading denotes non-usable light area

CURVE 5B

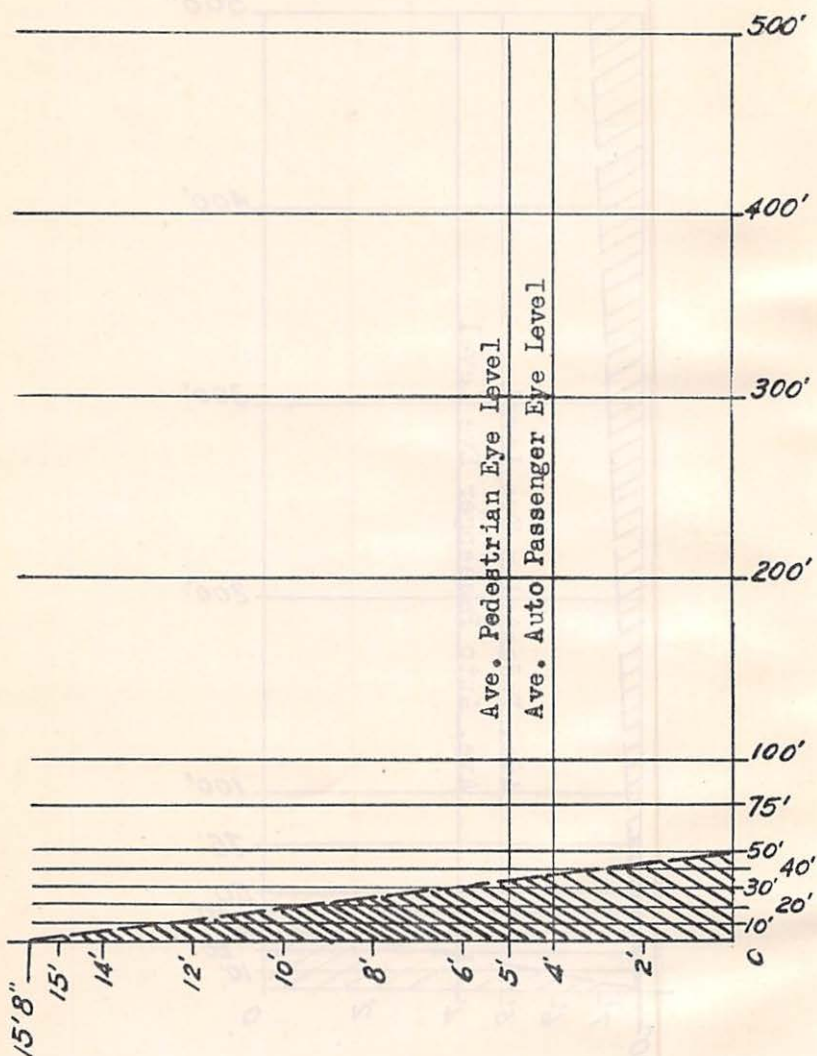
Roundel

D-Style B-B Traffic

Corning #14521

Shading denotes non-usable light area

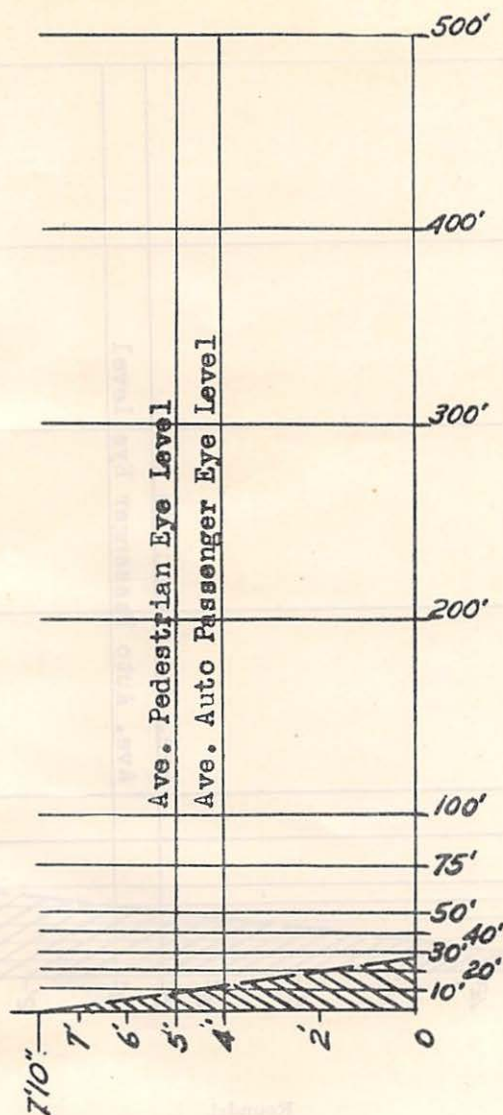
CURVE 6A

Roundel

D-Style B-B Traffic
 Corning #14521

Shading denotes non-usable light area

CURVE 6B

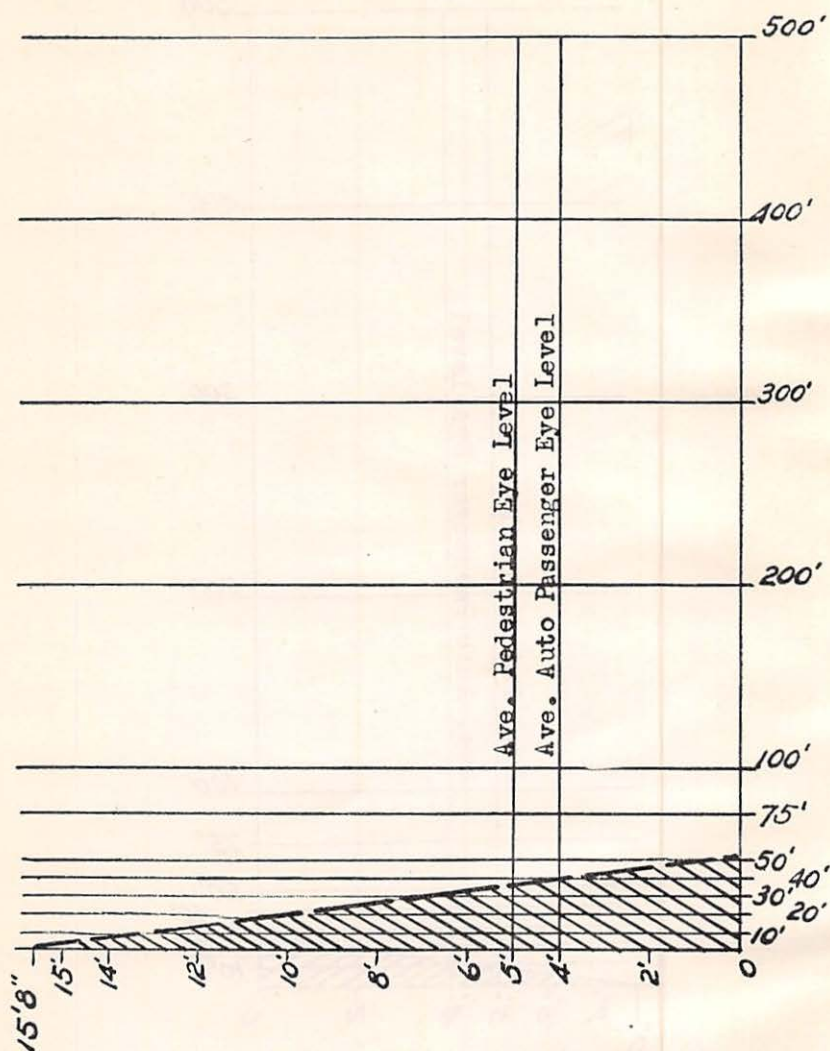
Roundel

Diffusing

Kopp TL 4620

Shading denotes non-usable light area

CURVE 7A



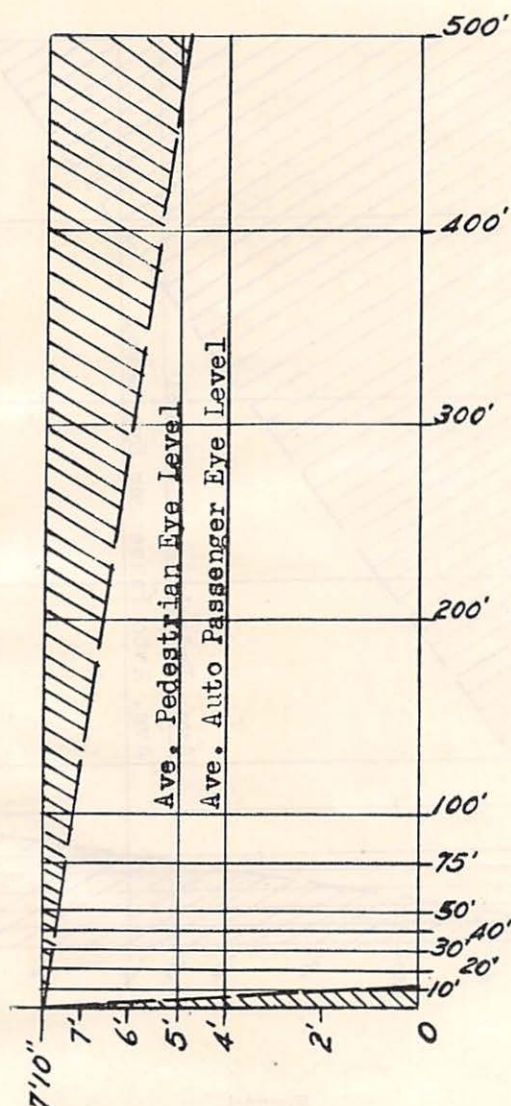
Roundel

Diffusing

Kopp TL 4620

Shading denotes non-usable light area

CURVE 7B

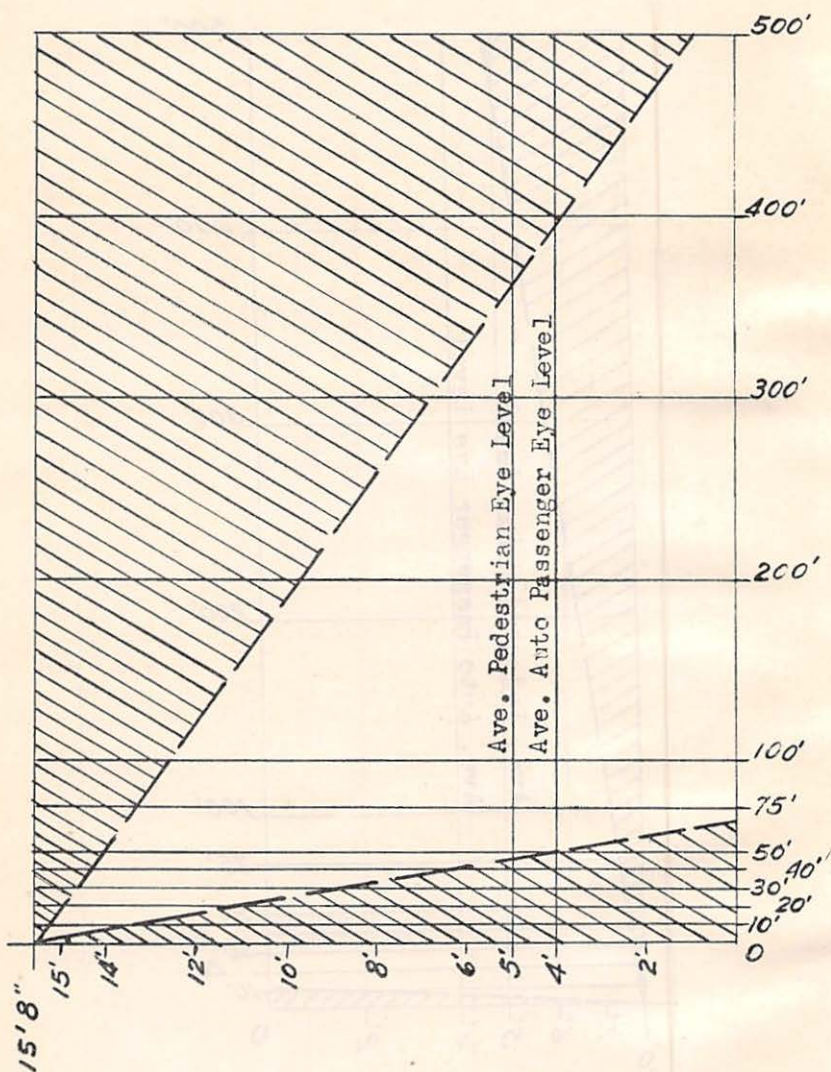


Roundel

Diffusing
Kopp 88A

Shading denotes non-usable light area

CURVE 8A

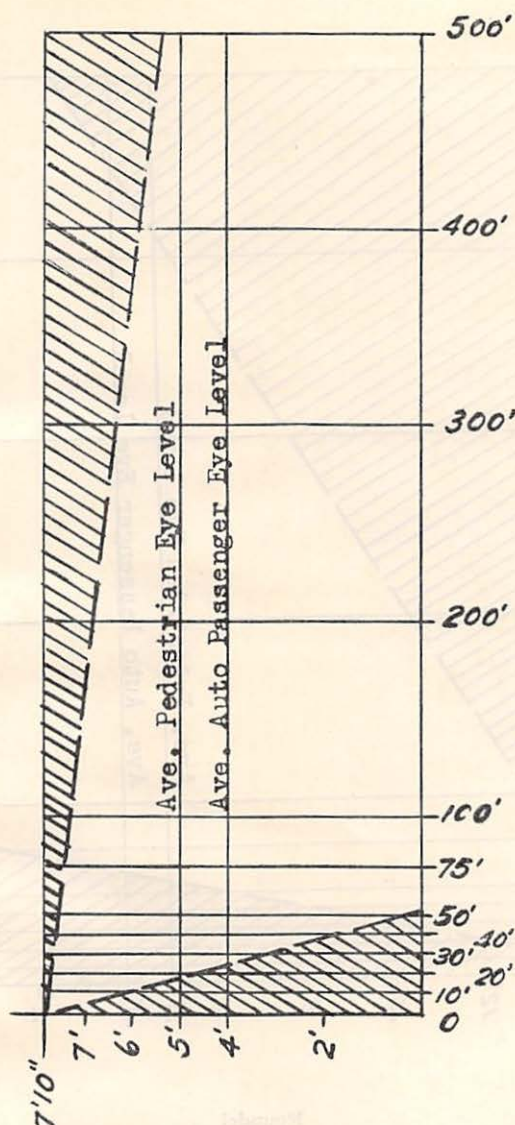


Roundel

Diffusing
 Kopp 88A

Shading denotes non-usable light area

CURVE 8B

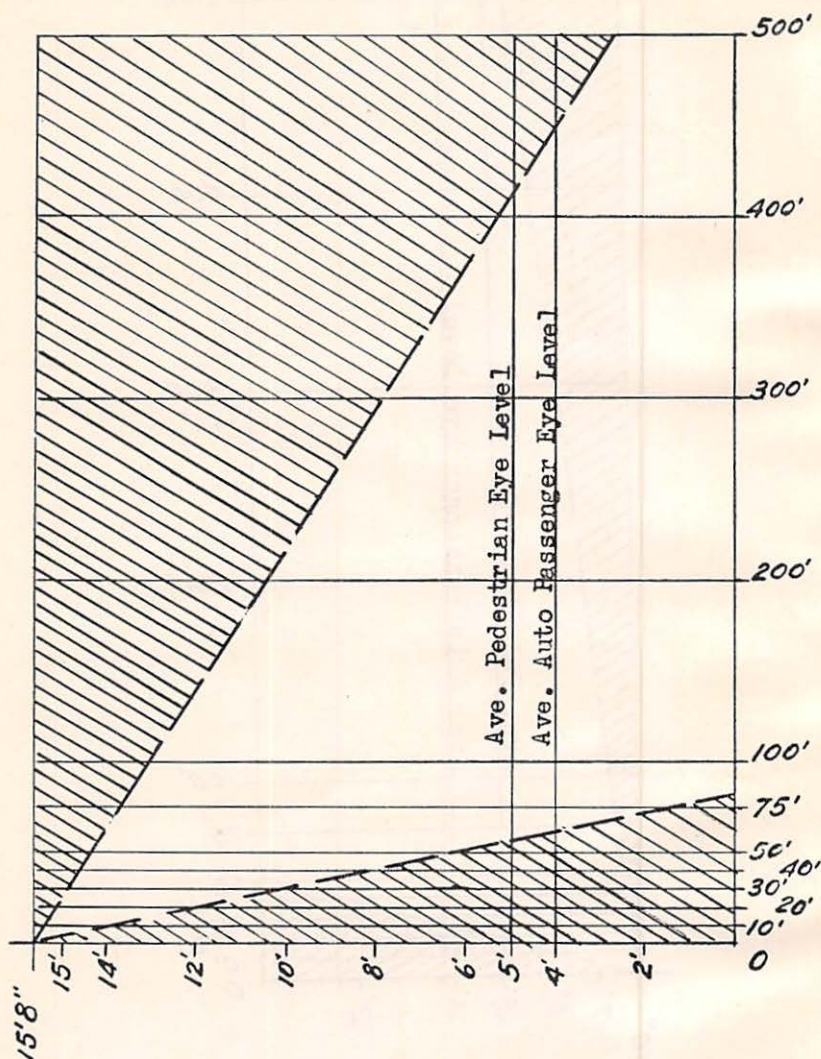


Roundel

Diffusing
Kopp 66

Shading denotes non-usable light area

CURVE 9A

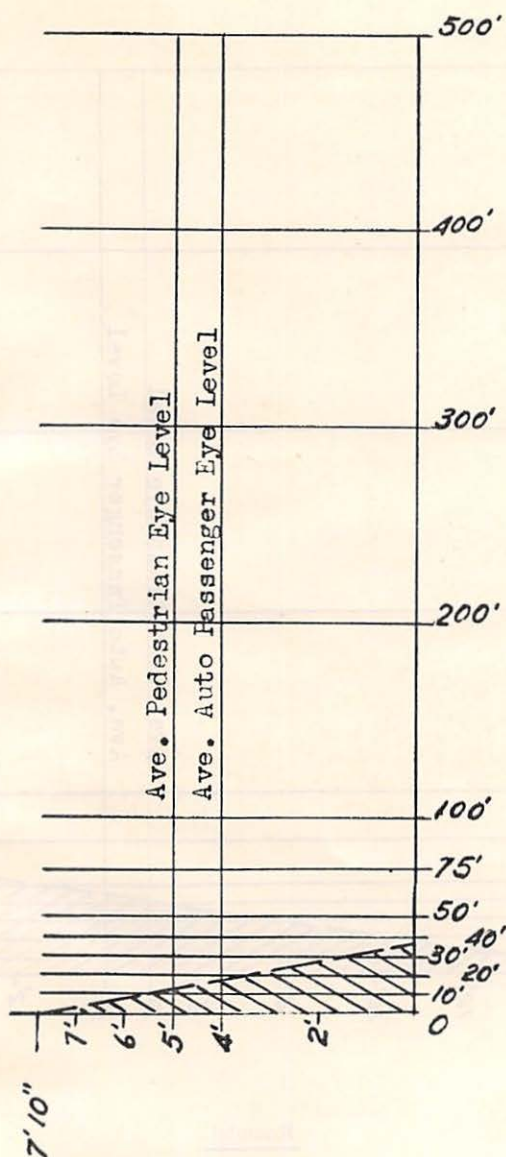


Roundel

Diffusing
Kopp #66

Shading denotes non-usable light area

CURVE 9B

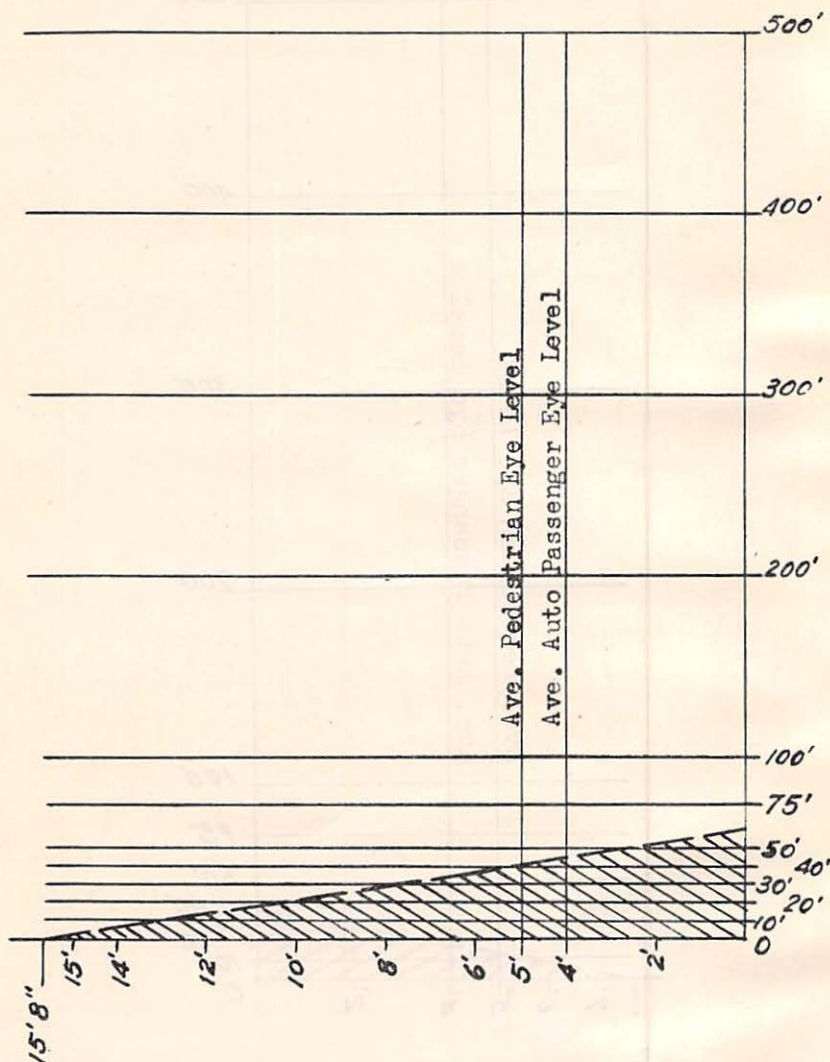


Diffusing

Corning #553400

Shading denotes non-usable light area

CURVE 10A

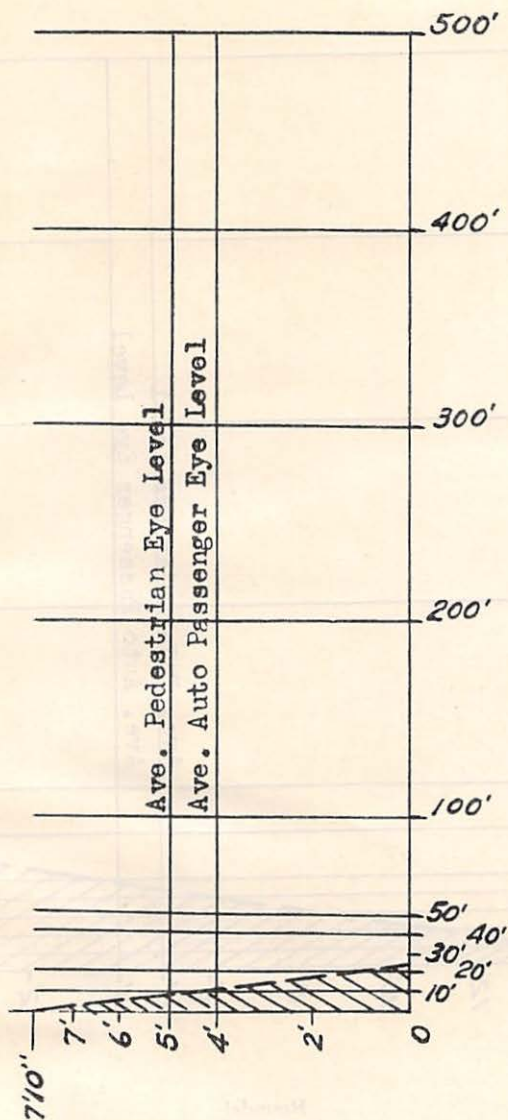


Roundel

Diffusing
Corning #553400

Shading denotes non-usable light area

CURVE 10B



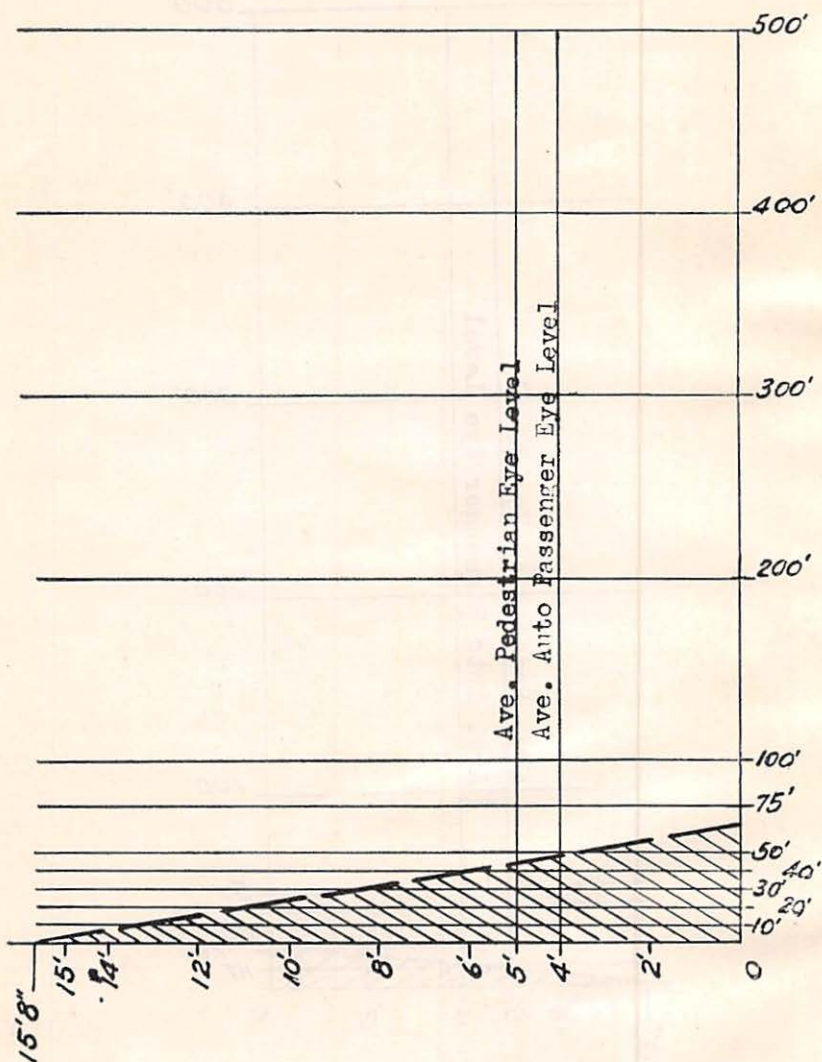
Roundel

Diffusing

Corning #ME4969

Shading denotes non-usable light area

CURVE 11A



Roundel

Diffusing
Corning ME 4969

Shading denotes non-usable light area

CURVE 11B

LOCATION PLANS FOR HIGHWAY GRADE CROSSING
PROTECTION DEVICES

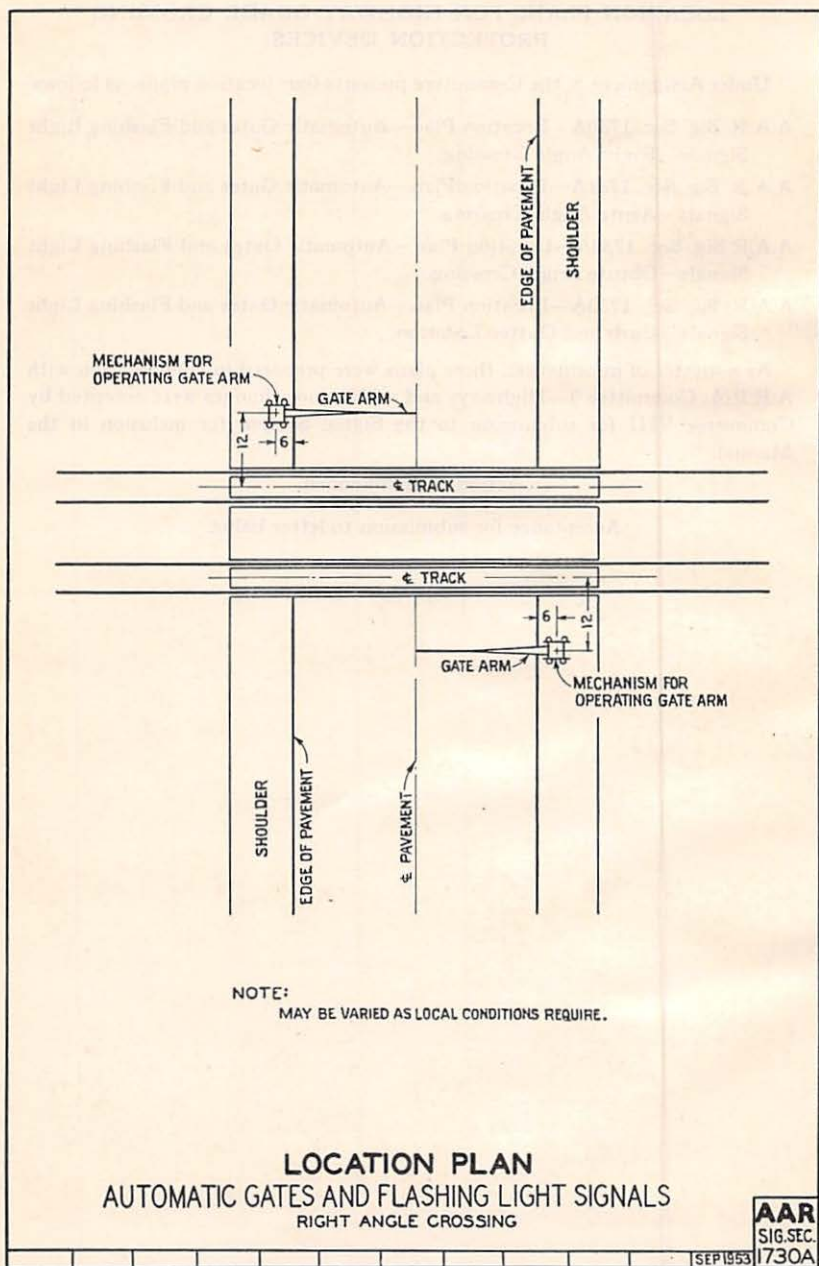
Under Assignment 5, the Committee presents four location plans, as follows:

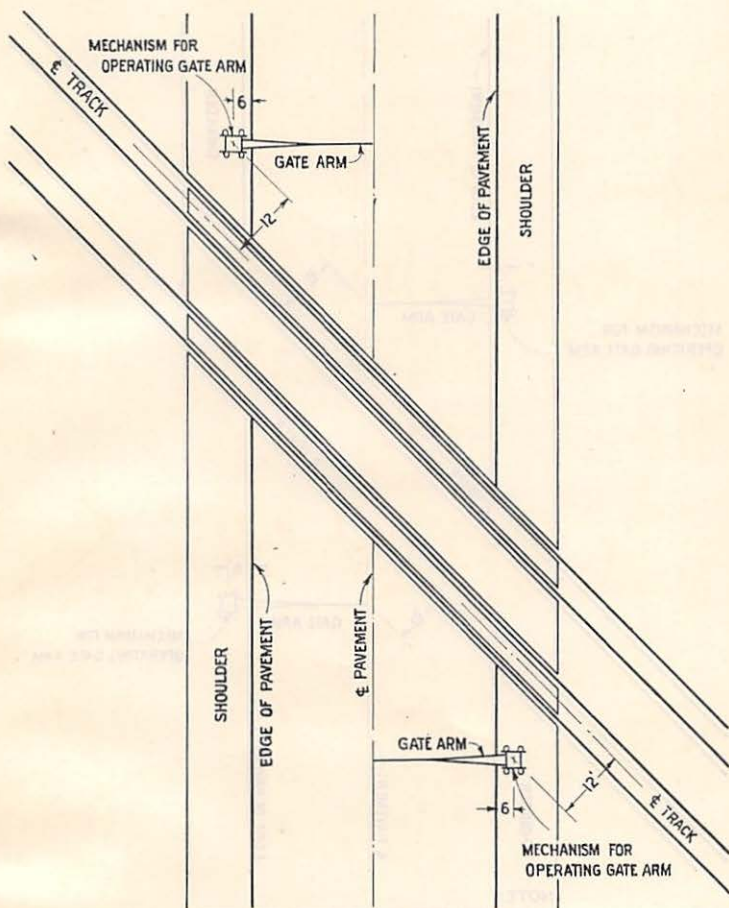
- A.A.R. Sig. Sec. 1730A—Location Plan—Automatic Gates and Flashing Light Signals—Right Angle Crossing.
A.A.R. Sig. Sec. 1731A—Location Plan—Automatic Gates and Flashing Light Signals—Acute Angle Crossing.
A.A.R. Sig. Sec. 1732A—Location Plan—Automatic Gates and Flashing Light Signals—Obtuse Angle Crossing.
A.A.R. Sig. Sec. 1733A—Location Plan—Automatic Gates and Flashing Light Signals—Curb and Gutter Location.

As a matter of information, these plans were prepared in collaboration with A.R.E.A. Committee 9—Highways and with minor changes were accepted by Committee VIII for submission to the Signal Section for inclusion in the Manual.

Action Recommended

Acceptance for submission to letter ballot.



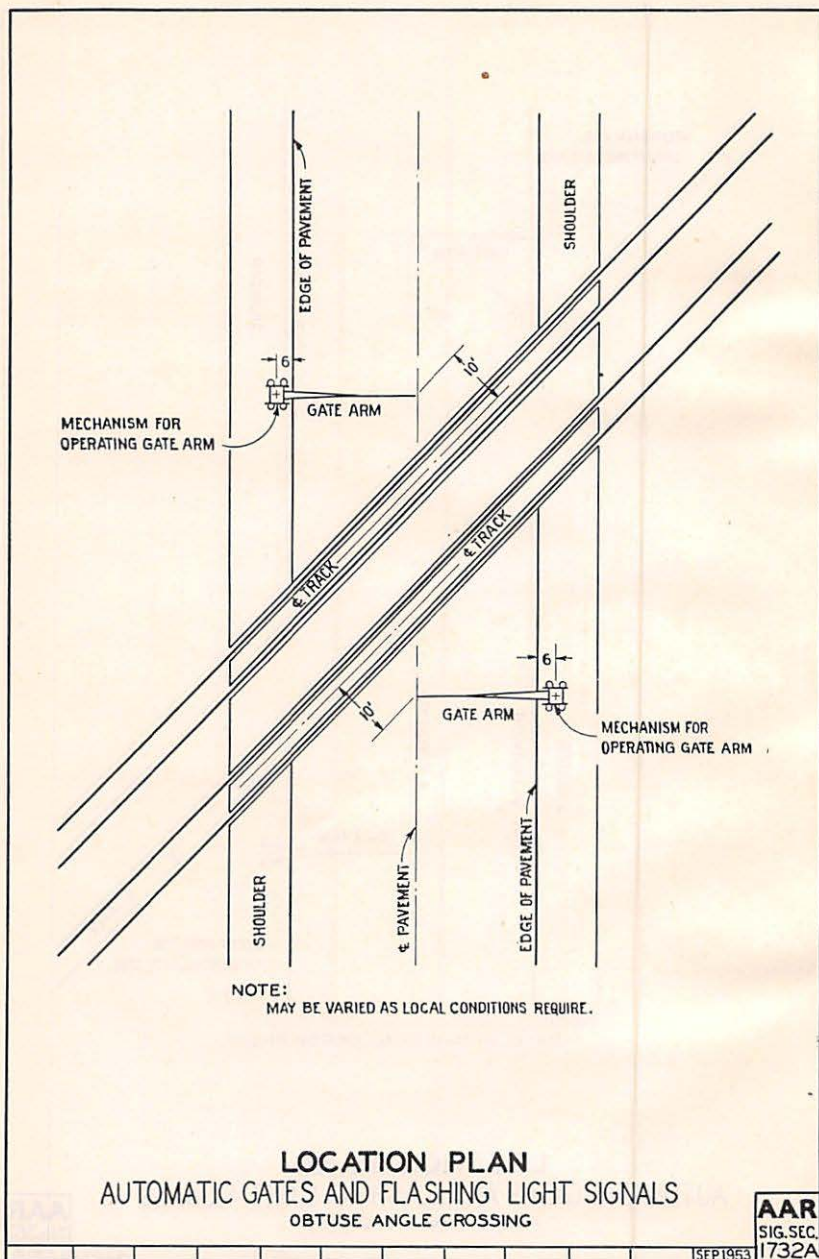


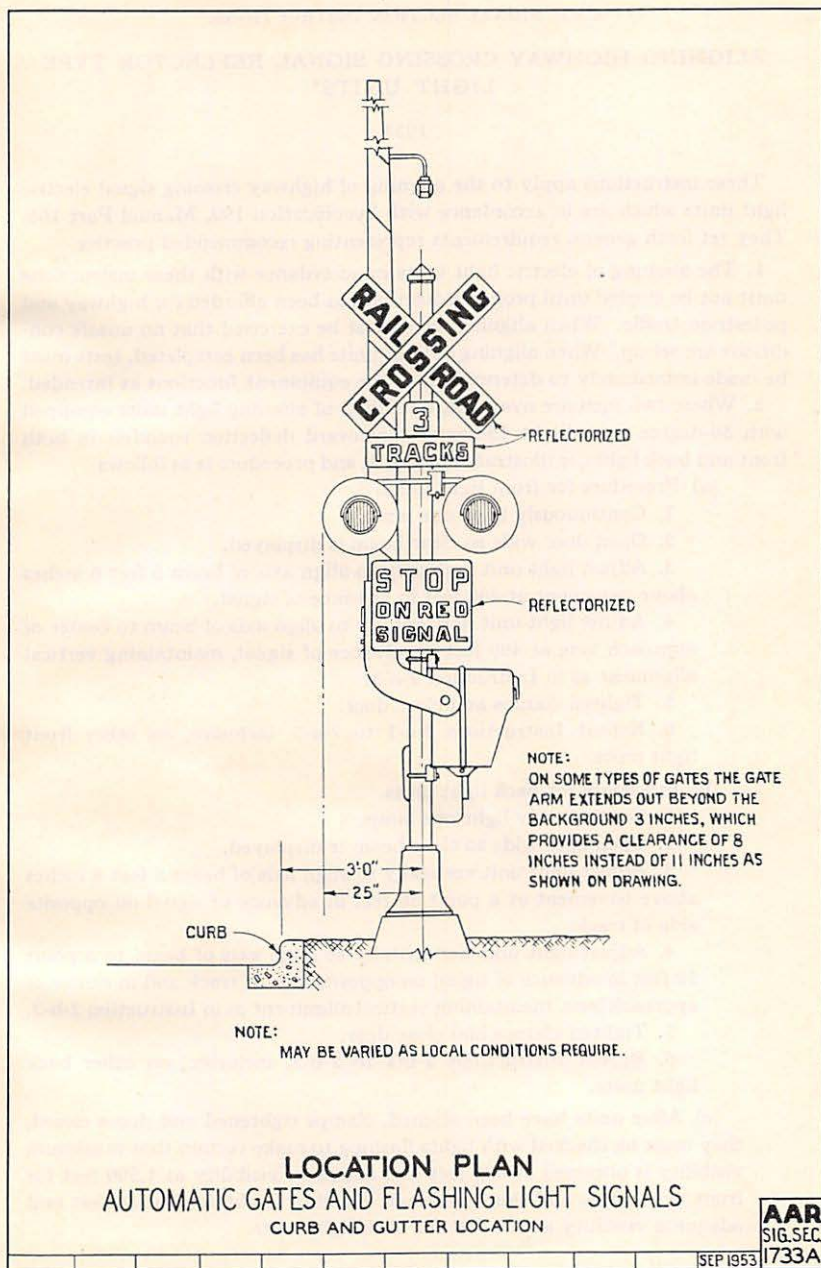
NOTE:
MAY BE VARIED AS LOCAL CONDITIONS REQUIRE.

LOCATION PLAN
AUTOMATIC GATES AND FLASHING LIGHT SIGNALS
ACUTE ANGLE CROSSING

AAR
SIG. SEC
1731A

SEP 1953





(Revision of Instructions for Focusing and Aligning Railroad-Highway Grade Crossing Flashing Light Signal Units, Reflector Type, with Sealed Lamp Receptacle)

A.A.R. SIGNAL SECTION INSTRUCTIONS.

ALIGNING HIGHWAY CROSSING SIGNAL REFLECTOR TYPE
LIGHT UNITS*

1953

These instructions apply to the aligning of highway crossing signal electric light units which are in accordance with Specification 190, Manual Part 166. They set forth general requirements representing recommended practice.

1. The aligning of electric light units in accordance with these instructions must not be started until proper protection has been afforded for highway and pedestrian traffic. When aligning, care must be exercised that no unsafe conditions are set up. When aligning of light units has been completed, tests must be made immediately to determine that the equipment functions as intended.

2. Where two men are available, a method of aligning light units equipped with 30-degree spreadlight 15-degree downward deflection roundels in both front and back lights, is illustrated in Fig. 1, and procedure is as follows:

(a) Procedure for front light units.

1. Continuously light one lamp.
2. Open door wide so clear beam is displayed.
3. Adjust light unit vertically to align axis of beam 5 feet 6 inches above pavement at 400 feet in advance of signal.
4. Adjust light unit horizontally to align axis of beam to center of approach lane at 400 feet in advance of signal, maintaining vertical alignment as in Instruction 2-a-3.
5. Tighten clamps and close door.
6. Repeat Instructions 2-a-1 to 2-a-5, inclusive, on other front light units.

(b) Procedure for back light units.

1. Continuously light one lamp.
2. Open door wide so clear beam is displayed.
3. Adjust light unit vertically to align axis of beam 5 feet 6 inches above pavement at a point 50 feet in advance of signal on opposite side of track.
4. Adjust light unit horizontally to align axis of beam to a point 50 feet in advance of signal on opposite side of track and in center of approach lane, maintaining vertical alignment as in Instruction 2-b-3.
5. Tighten clamps and close door.
6. Repeat Instructions 2-b-1 to 2-b-5, inclusive, on other back light units.

(c) After units have been aligned, clamps tightened and doors closed, they must be checked with lights flashing to make certain that maximum visibility is obtained at 400 feet and adequate visibility at 1,500 feet for front light units, and that maximum visibility is obtained at 50 feet and adequate visibility at 400 feet for back light units.

* The term "as instructed" as used herein refers to individual railroad instructions.

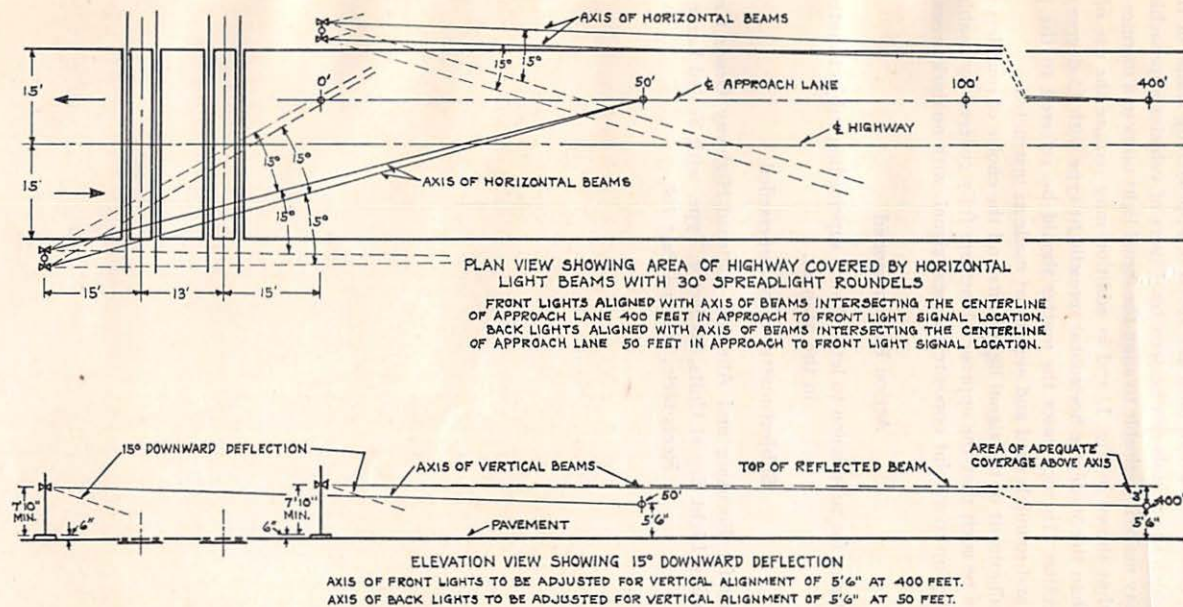


FIG. 1.

3. Wherever a device is used to minimize the possibility of a phantom indication, the beam candlepower is reduced to the extent that higher than normal wattage lamps may be required to obtain adequate visibility.

4. Local conditions which limit the speed of approaching traffic or the distance at which the signals can be seen by drivers of vehicles approaching the crossing may make it desirable to align the signal light units in a manner differing from that shown in Fig. 1, and in addition may require the use of other roundels than the 30-degree horizontal spreadlight type with 15-degree downward deflection. In such cases the matter should be referred to the proper authority and roundels used and alignment made as instructed.

5. The alignment of the signal light units and the choice of roundels should in all cases be such that the approach lanes are fully covered by usable light continuously up to a point opposite the near signal, with no dark areas.

Action Recommended

Acceptance for submission to letter ballot superseding subject-matter in the Manual.

Subject-matter to be Superseded

Instructions for Focusing and Aligning Railroad-Highway Grade Crossing Flashing Light Signal Units, Reflector Type, with Sealed Lamp Receptacle, Manual Part 268.

COMMITTEE IX—WIRE AND CABLE

Personnel

W. W. Beard, Chairman	
E. P. Stephenson, Vice-Chairman	
F. R. Bliss	V. O. Smeltzer
H. H. Cooper	C. L. Summers
R. W. Margsh	W. M. Vogts
M. A. Nyberg	R. H. Youngblood

Signal Section, A.A.R.:

The following outline of work has been assigned:

1. Revision of Manual.
2. Indexing signal literature.
3. Investigate and report on wire used for internal wiring of all types of apparatus.
4. Investigate and report on the use of stainless steel guy and messenger strand.
5. Investigate and report on the use of plastic electrical tape.

The Committee submits for consideration, reports on the following subjects*:

1. Revision of Specification 54-39, Manual Part 24.
4. Memorandum on stainless steel strand.

Cooperative report. American Standards Association—Technical Committee, Project C8.18—No. 12—Weather-Resistant Wire.

Information

Specifications, etc., of other organizations referred to in the report of this Committee may be procured from the following:

A.S.A.—American Standards Association, 70 E. 45th St., New York 17, N. Y.
A.S.T.M.—American Society for Testing Materials, 1916 Race St., Philadelphia 3, Pa.

Disposition of 1952 Letter Ballot Subjects

The following subjects presented by Committee IX at the 1952 Annual Meeting were submitted to letter ballot and officially approved:

- Specification 91-52—Lead Sheathed Cable, Non-Armored—Now in Manual Part 28.
- Specification 145-52—Lead Sheathed Cable, Armored—Now in Manual Part 20.
- Specification 90-52—Lead Sheathed Cable, Submarine—Now in Manual Part 26.
- Specification 240-52—Polychloroprene Sheathed Cable—Now in Manual Part 249.

* Suggestions or criticisms should be submitted in writing to the Chairman of the Committee on or before August 28, 1953.

- Specification 161-52—Polychloroprene Sheathed Cable with Outer Covering—
Now in Manual Part 36.
- Specification 89-52—Braid-Covered Cable—Now in Manual Part 25.
- Specification 111-52—Insulated Wire—Now in Manual Part 186.
- Specification 192-52—Insulated Wire, A.V.C.—Now in Manual Part 187.
- Specification 169-52—Copper Line Wire—Now in Manual Part 182.
- Specification 168-52—Copper Alloy Line Wire—Now in Manual Part 173.
- Specification 167-52—Copper-Covered Steel Line Wire—Now in Manual
Part 180.
- Specification 196-52—Copper-Bearing Steel Line Wire—Now in Manual
Part 181.
- Specification 108-52—Copper Bond Wire—Now in Manual Part 175.
- Specification 70-52—Copper-Covered Steel Bond Wire—Now in Manual
Part 176.
- Wire Inspection Report—Obsolete—Removed from Manual Part 178.
- Specification 22-52—Galvanized E.B.B. Steel Bond Wire—Now in Manual
Part 177.
- Specification 54-52—Aluminum Cable Steel Reinforced Line Wire—Now in
Manual Part 24.
- Specification for Vitriified Clay Conduit—Obsolete—Removed from Manual
Part 41.

MEMORANDUM ON STAINLESS STEEL STRAND

The rapidly spreading use of stainless steel strand during the past 7 years has brought about a general recognition of the fact that its use instead of galvanized, copper-covered or aluminum strand is justified wherever the local conditions are unusually bad.

The three types of stainless steel strand are commercially accepted now, together with standard physical properties, according to the following table:

Type AISI* No.	Composition	Tensile strength individual wires, p.s.i.	Corrosion fatigue limit	Young's modulus	Coefficient of linear expansion
430	17% Cr.	135000/155000	40% of Ult.	24×10^6	$5.1 \times 10^{-6}/^{\circ}\text{F.}$
301-302	Cr.-Ni.	235000/255000	50% of Ult.	21×10^6	$9.2 \times 10^{-6}/^{\circ}\text{F.}$
316	Cr.-Ni.-Mo.	210000/230000	55% of Ult.	21×10^6	$9.4 \times 10^{-6}/^{\circ}\text{F.}$

Breaking Strengths in Pounds

	$\frac{1}{4}" \times 3$	$\frac{3}{8}" \times 3$	$\frac{1}{2}" \times 3$	$\frac{1}{4}" \times 7$	$\frac{3}{8}" \times 7$	$\frac{1}{2}" \times 7$
430	4,350	6,300	8,200	4,900	6,150	7,600
301	7,550	11,000	14,300	8,500	10,700	13,200
316	6,880	9,900	12,900	7,650	9,630	11,900
	$\frac{3}{8}" \times 7$	$\frac{1}{2}" \times 7$	$\frac{3}{4}" \times 7$			
430	10,000	15,000	19,500			
301	18,000	26,000	33,700			
316	16,200	23,400	30,300			

* American Iron and Steel Institute.

Under N.P.A. regulations and due to shortage of nickel, only Type 430 (straight chrome) may presently be procured without special authorization by N.P.A. in Washington, D. C. In a free market, however, the following observations might be applicable:

1. The use of stainless strand is indicated wherever galvanized strand has a safe life of less than 15 years.
2. Stainless strand should be used where utmost reliability is required or where abnormal conditions may be expected.
3. Type 430 strand should be used in mildly corrosive locations (life of galvanized strand 10-15 years).
4. Type 301-302 strand should be used in strongly corrosive locations (life of galvanized strand 5-10 years) or where utmost strength and corrosion fatigue life is required.
5. Type 316 strand should be used in exceptionally bad locations—near chemical plant, sea coasts, and tunnels.

When stainless strand is used as a messenger, the same type lashing wire should be used to hold the cable. However, even when galvanized steel messengers are used, Type 430 lashing wire is recommended for reliability and endurance.

Either heavily galvanized pole line hardware or stainless fittings (now obtainable commercially) may be used with all types of stainless strand.

Specifications

The only recognized specification is Western Electric Co. (Bell Telephone—Laboratories) AT-7213 Issue 1, which specifies Type 430 for $\frac{5}{32}$ " 1 x 7 strand (breaking strength 6,000 lbs.) and Type 301 or 302 for $\frac{5}{16}$ " and $\frac{3}{8}$ " strand. It is hoped that A.S.T.M. will bring out standard stainless strand specifications covering Types 430, 301, 302 and 316, thus simplifying procurement and production.

Action Recommended

Acceptance as information.

(Revision of A.A.R. Signal Section Specification 54-39)
A.A.R. SIGNAL SECTION SPECIFICATION 54-53.

STRANDED ALUMINUM LINE WIRE

1. *Purpose.*

(a) This specification is for the purpose of providing for concentric-lay-stranded aluminum conductor, steel reinforced, for use as line wire. It sets forth specific detail requirements representing modern signal practice recommended for new installations and for replacement on existing installations when general renewal or replacement becomes desirable.

2. *Specifications.*

(a) Specifications referred to in the body of this specification form an essential part hereof.

3. *Tender.*

(a) The tender shall be for a product meeting the requirements of this specification in its entirety.

4. *Purchaser's order requirements.*

(a) The following additional requirements will be shown on Purchaser's order:

1. Inspection and tests as required.
2. Alternate requisites as required.

5. *Alternates.*

(a) The provisions contained in the alternate requisites section of this specification form a part hereof only when substituted by Purchaser's order for the provisions contained in this specification.

6. *Material and workmanship.*

(a) Material and workmanship shall be first-class in every respect.

7. *Conductor.*

(a) Before stranding, the aluminum wires used shall meet all the requirements of A.S.T.M. current Specification B 230.

(b) Before stranding, the zinc-coated steel wire used shall meet all the requirements of A.S.T.M. current Specification B245.

(c) Electric butt welds in the finished individual aluminum wires composing the conductor may be made during the stranding process. No weld shall occur within 50 ft. of a weld in the same wire or in any other wire of the completed conductor.

(d) There shall be no joints of any kind made in the finished zinc-coated steel wire.

8. *Assembly.*

(a) The preferred lay of a stranded conductor having a single wire steel core and one layer of aluminum wires is 13 times the outside diameter of a single strand but shall be not less than 12 nor more than 14.5 times that diameter.

(b) The direction of lay of the aluminum wires shall be right-hand. *R-8-b.

(c) The number and diameter of aluminum and steel wires and the areas of cross-section of aluminum wires shall be in accordance with Table I.

TABLE I

Conductor size (aluminum)		Aluminum		Stranding		Steel	
Circular mils	A.W.G.	No. of wires	Diameter, inches	No. of wires	Diameter, inches	No. of wires	Diameter, inches
133,100	00	6	0.1490	1	0.1490		
105,600	0	6	0.1327	1	0.1327		
83,690	1	6	0.1182	1	0.1182		
66,360	2	7	0.0974	1	0.1299		
66,360	2	6	0.1052	1	0.1052		
52,620	3	6	0.0937	1	0.0937		
41,740	4	7	0.0772	1	0.1029		
41,740	4	6	0.0834	1	0.0834		
33,090	5	6	0.0743	1	0.0743		
26,240	6	6	0.0661	1	0.0661		

9. *Physical and electrical tests.*

(a) Tests for physical and electrical properties of aluminum wires used in the conductor shall be made before stranding in accordance with, and shall meet the requirements of, A.S.T.M. current Specification B 230.

(b) Tests for all properties of zinc-coated steel wire used in the conductor shall be made before stranding in accordance with, and shall meet the requirements of, A.S.T.M. current Specification B 245.

(c) Tests for ultimate tensile strength of completed conductor** shall be made in accordance with, and meet the requirements of, A.S.T.M. current Specification 232. *R-9-c.

(d) When tests are so made, the ultimate tensile strength of the conductor shall be at least 95 per cent of the calculated conductor strength.

* Alternate requisites section.

** Testing of aluminum conductor, steel reinforced, for ultimate tensile strength as a unit requires special devices for gripping the ends of the aluminum wires and the steel wire separately. Special dead-end devices are available at certain manufacturing plants. The conductor testing facilities of many commercial laboratories are limited to a breaking strength of 30,000 lbs. or less. Consequently, it may not be feasible to test very large sizes of conductors as a unit. Where such tests are imperative, special arrangements for testing shall be agreed upon between Manufacturer and Purchaser at the time of placing the order.

10. *Density.*

(a) For the purpose of calculating weights, cross-sections, etc., the density of aluminum shall be taken as 2.703 grams per cu. cm. (0.09765 lb. per cu. in.) at 68 deg. F.

(b) For the purpose of calculating weights, cross-sections, etc., the density of galvanized steel wire shall be taken as 7.78 grams per cu. cm. (0.281 lb. per cu. in.) at 68 deg. F.

11. *Weight and electrical resistance.*

(a) The weight and electrical resistance of a stranded conductor are greater than the total of these characteristics of the wires composing the conductor depending upon the lay. The standard increments shall be taken as shown in Table II.

TABLE II

Stranding of ACSR Number of wires Aluminum Steel	Increment (increase), per cent		Electrical resistance
	Weight Aluminum	Steel	
6 1	1.5	0	1.5
7 1	1.5	0	1.5

(b) In cases where the lay is definitely known, the increments may be calculated if desired.

(c) In the calculation of the electrical resistance of a completed conductor, the zinc-coated steel core shall be neglected.

12. *Cross-section area.*

(a) The area of cross-section of the aluminum wires of a conductor shall be not less than 98 per cent of the area specified. The area of cross-section shall be considered to be the sum of the cross-sectional areas of the component aluminum wires at any section when measured perpendicularly to their individual axes.

13. *Inspection.*

(a) All tests and inspection shall be made at the place of final manufacture unless otherwise agreed upon by Manufacturer and Purchaser at the time of purchase. Manufacturer shall afford the inspector representing Purchaser all reasonable facilities, without charge, to satisfy him that the material is being manufactured in accordance with these specifications.

(b) In the event inspection is waived, Manufacturer shall upon request of Purchaser at time of placing order furnish certified test reports. Acceptance shall not relieve Manufacturer of furnishing material in accordance with this specification.

14. *Tests.*

(a) Tests may be made at point of production, or on samples submitted, and may also be made at destination.

(b) Manufacturer shall give Purchaser sufficient notice of time when the material or product will be ready for testing.

14. *Tests.*—Continued.

(c) Manufacturer shall provide, at point of production, apparatus and labor for making required tests under supervision of Purchaser.

(d) If tests are to be made at point of production, it shall be so stated on Purchaser's order. Purchaser shall indicate which of the tests herein specified are to be made and what portion of the material or product shall be tested.

15. *Packing.*

(a) Product shall be so assembled or packed as to permit convenient handling and to protect against loss or damage during shipment.

(b) The conductor shall be shipped on substantially constructed reels that are of suitable size and in good condition. The reels shall be properly lagged or otherwise protected. *R-15-b.

(c) Reels shall be provided with cast-iron bushing or iron plate at the center on each side having hole of sufficient size to take shaft suitable for the weight of the conductor.

16. *Marking.*

(a) Purchaser's order, requisition and package number, name of Consignor, and name and address of Consignee, shall be plainly marked on outside of packages and on tags attached to loose pieces.

(b) Detail list of reels and coils and their contents shall be furnished for each shipment. Where carload shipments are made, routing and car identification shall be shown.

(c) A tag shall be firmly attached to each reel and coil of conductor showing the size, kind of conductor, stranding, class of zinc coating, and any other necessary identification.

(d) Reels shall be plainly stenciled with arrow and suitable accompanying wording on each end of reel, indicating which way it shall be rolled, number of feet, and gross weight of reel.

17. *Warranty.*

(a) Manufacturer shall warrant the product covered by this specification to be free from defects in material and workmanship under ordinary use and service, his obligation under this warranty being limited to manufacturing, at point of production, any part or parts to replace those which shall be found defective within 1 year after shipment to Purchaser. This warranty shall not apply to any product which has been subjected to misuse, negligence or accident.

Alternate requisites.

R-8-b.

The direction of lay of the aluminum wires shall be left-hand.

* Alternate requisites section.

Alternate requisites.—Continued.

R-9-c.

Tests for ultimate tensile strength of completed conductor are not required.

R-15-b.

The conductor shall be shipped in coils. Each unit of shipment shall be thoroughly wrapped with strong paper or with burlap, so as to be protected against damage in ordinary handling and transportation.

Action Recommended

Acceptance for submission to letter ballot superseding subject-matter in the Manual.

Subject-matter to be Superseded

Specification 54-39—Aerial Aluminum Cable Steel Reinforced,
Manual Part 24.

COOPERATIVE REPORT

AMERICAN STANDARDS ASSOCIATION
TECHNICAL COMMITTEE

PROJECT C8.18—NO. 12—WEATHER-RESISTANT WIRE

W. W. Beard, Representative

A meeting of this Committee was held in New York, N. Y. on April 23 and 24, 1952, at which the following assignments were presented for discussion:

1. Revision of A.S.A. Specification C8.18, Weather-Resistant Wire and Cable to provide for braid construction of glass and cotton, or glass. It is also proposed to include copper-covered steel, aluminum, and ACSR conductors in this specification.
2. Proposed new specification for Neoprene type weather-resistant wire and cable.
3. Proposed new specification for Polyethylene type weather-resistant wire and cable.
4. Proposed new specification for Polyvinyl-chloride type weather-resistant wire and cable.

Because of considerable divergence of opinion regarding the wording of proposed revisions, it was decided to rewrite certain controversial paragraphs in an effort to reconcile differences of opinion.

The revised paragraphs will be submitted for discussion at the next meeting.

Action Recommended

Acceptance as information.

COMMITTEE X—SIGNALING PRACTICE

Personnel

G. K. Thomas, Chairman

W. G. Salmonson, Vice-Chairman

J. A. Beoddy

S. B. Higginbottom

C. M. Bishop

S. W. Law

J. J. Corcoran

H. G. Morgan

E. N. Fox

S. E. Noble

H. B. Garrett

W. S. Storms

W. N. Hartman

L. C. Walters

T. W. Hays

J. S. Webb

W. W. Welsh

Signal Section, A.A.R.:

The following outline of work has been assigned:

1. Revision of Manual.
2. Indexing signal literature.
3. Report on noteworthy changes in signal practices.
4. Recommend uniform signal practice in the use of aspects and indications for railway signaling.
5. Requisites for automatic train control, automatic stop and cab signal systems.
6. Investigate and report on new and improved signal devices and related appliances.
7. Investigate and report on light out protection.
8. Investigate and report on the practicability of developing a portable speed recorder for determination of the speed of a passing train by direct reading.
9. Requisites for classification yard systems.

The Committee submits for consideration, reports on the following subjects*:

3. Report on noteworthy changes in signaling practice.
6. New and improved signal devices and related appliances.
9. Requisites for classification yard systems.

Battelle Memorial Institute Report (Section VI—Signaling) on "A Preliminary Investigation of the Possibilities of Expansion of Railroad Electrification in the United States."

Disposition of 1952 Letter Ballot Subjects

The following subjects presented by Committee X at the 1952 Annual Meeting were submitted to letter ballot and officially approved:

Requisites for Traffic Control Systems—Now in Manual Part 86.

Signaling for Gravity Classification Yards—Now in Manual Part 42.

* Suggestions or criticisms should be submitted in writing to the Chairman of the Committee on or before August 28, 1953.

Explanatory Statement

In connection with Assignment 9—Requisites for classification yard systems, the Committee is submitting requisites that are new and that are intended to serve as a guide for the general requirements to be met in the design and the installation of classification yard systems.

For many years the only guidance has been in (1) a general major specification for car retarder system, (2) maintenance instructions for car retarder systems, and (3) signaling for gravity classification yards. Recently there were added several unit specifications for details such as control machines, retarders, switch operating mechanisms and skate mechanisms for yards for both electric and electro-pneumatic operation.

It appeared desirable to develop requisites for the modern automatic switching operation in a retarder equipped yard. It became apparent that many requisites would be common to both the manual and the automatic operation, and also that each required certain basic requisites that were not common. The requisites now presented, therefore, are general for all classification yard systems and include recommended general requirements to be followed for signaling, for manual control or automatic control of switches and for manual control or speed control of retarders.

A.A.R. SIGNAL SECTION REQUISITES.

CLASSIFICATION YARD SYSTEMS

1953

1. *Purpose.*

(a) These requisites are for the purpose of setting forth the recommended general requirements for classification yard systems. They set forth specific detail requirements representing modern signal practice recommended for new installations and for replacement of existing installations when general renewal or replacement becomes desirable.

2. *Signaling.*

(a) Signaling shall be in accordance with Signaling for Gravity Classification Yards, Manual Part 42, and signal control circuits shall be designed on the closed circuit principle.

1. Controls for hump and trimmer signals shall be located at the crest of the hump and where desired additional control points may be provided.
2. Where cab signals are used their aspects and indications shall be in accordance with those for hump signals.

3. *Switch and route controls.*

(a) General.

1. Detector track circuits shall be provided.
2. A normal and reverse switch indication or equivalent shall be provided for each switch.

3. *Switch and route controls.*—Continued.

3. Where operating rules permit intentional trailing through switches, control circuits may be so arranged that if the switch is trailed through, switch points shall be held in the trailed position until detector track circuit is cleared, at which time the switch points shall assume a position in agreement with that of the control machine lever.

(b) Manual.

1. Switch control circuits shall be so designed that the position of the switch points will correspond to the position of the control lever except as follows:

(a) When control lever is thrown to opposite position when detector circuit is occupied.

(b) When switch machine of dual control type is in "hand throw" operation.

(c) When switch is being trailed through while detector circuit is occupied or when a switch has been trailed through and switch does not return to original position and out-of-correspondence indication is given on the control machine.

(c) Automatic.

1. Manual control of switches will take precedence over automatic control.

2. Controls shall be so designed that switches will position to selected routes as car or cuts progress.

3. An arrangement shall be provided which automatically restores to its previous position any switch which fails to complete a called for movement within its normal operating time and which also gives an indication to the operator that the switch has been unable to complete its intended movement.

4. Means shall be provided for canceling routes or remaining portion of a route.

5. Test facilities shall be provided to permit maintenance forces to simulate movements to any classification track.

4. *Retarder controls.*

(a) Manual.

1. Controls shall permit selection of retarder pressure to provide retardation required.

(b) Speed control.

1. Manual control shall take precedence over speed control.

2. Controls shall be provided to affect retarder operation to obtain car speeds for selections established.

5. *Control machine.*

(a) Control machine shall be in accordance with Specification 241 or 245, Manual Part 252 or 251.

6. *Switch machines.*

(a) Switch machines shall be in accordance with Specification 243 or 247, Manual Part 256 or 255.

7. *Skate operating mechanisms.*

(a) Skate operating mechanisms shall be in accordance with Specification 244 or 248, Manual Part 258 or 257.

8. *Car retarder.*

(a) Car retarder shall be in accordance with Specification 242 or 246, Manual Part 254 or 253.

9. *Track circuits.*

(a) Detector track circuits shall be operated with quick drop-away relays and shall provide a high degree of shunting sensitivity.

(b) Detector track circuits shall have proper approach distances in advance of switch points for speed of traffic, mechanisms, and circuit.

(c) The length of the detector track circuit shall be such that it cannot be spanned by the longest car generally handled. In general practice this is 55 ft. minimum. Special cars whose inner wheel base exceeds the minimum track circuit length will require special handling.

(d) Timing track circuits for speed control shall be sensitive fast operating circuits.

(e) Clearance track circuits may be either open or closed circuit design.

10. *Power supply.*

(a) Power supply shall be adequate for the service required and emergency sources be provided as warranted.

11. *Communications.*

(a) Facilities for direct independent communication shall be provided between points of control and crest of hump.

(b) Facilities for communication between hump and hump engines are desirable.

12. *Dragging equipment detectors.*

(a) Dragging equipment detectors may be provided for movements approaching the hump.

13. *Flood lighting.*

(a) Flood lighting shall be provided to permit operation during the hours of darkness.

Action Recommended

Acceptance for submission to letter ballot.

REPORT ON NOTEWORTHY CHANGES IN SIGNALING
PRACTICE**Siding to siding block indication in traffic control systems.*

In traffic control systems employing reversible coded track circuits for control of intermediate signals, polarized coded track circuits using the three-position code following track relay listed as a new device in the report of Committee X presented at the 1952 Annual Meeting† are being used advantageously to provide a siding to siding block indication without line wires. Here the plus polarity in combination with the "clear code" frequency reflects an unoccupied block. Signals are controlled by the code frequency. In three-position signaling, the polarized track circuits are required only when two or more intermediate signals in a siding to siding block are used; moreover, they are required only for that portion of the block where the clear code would not reflect the remainder of the block to be "clear."

Delaying the start of highway crossing signals where long approach track circuits are used.

A capacitor timing unit is being used effectively to delay the start of highway crossing signals for a predetermined time where approach track sections exceed the length required to provide adequate warning time. When used for this purpose, circuit safeguards are employed to protect against a momentary loss of shunt resulting in re-energizing the capacitor unit which might shorten the warning time of the crossing signal below that desired.

Retarder speed control.

A retarder speed control system has come into use in gravity type classification yards. The system automatically regulates braking action so that cars or cuts of cars will leave car retarders at speeds that are predetermined by push button manipulation. A group of push buttons is provided for each retarder and each button is assigned a different speed setting. To select the speed at which a cut is to leave a retarder, an operator presses the push button marked with the desired speed in miles per hour.

Since the braking action is produced automatically as the cut travels through the retarder, the operator can devote more time to observing the speed and action of cuts between retarders and choosing the proper speeds at which they should leave the retarders. Such speeds are usually based on car weight, rolling characteristics of the car, weather, and other factors.

The retarder is normally closed under pressure determined by speed selection and, when a car enters, the pressure is regulated automatically in response to car speed measurements so that cars will leave the retarder at the selected speed. The car speed measurements start when the first pair of car wheels enters the retarder and continue until the last pair of wheels on the car (or cut) leaves the retarder.

* Previous report on this subject appears in A.A.R. Signal Section 1951 Proceedings, Vol. XLIX, p. 299.

† A.A.R. Signal Section 1951 Proceedings, Vol. XLIX, p. 300.

Automatic positive identification of trains.

A system for automatic positive identification of trains, with remote indication and recording of identifications, is being used. This is a sweep-frequency train identification system in which a track coil mounted between the running rails is coupled momentarily to a tuned train coil on passing trains. During this period of coupling, the wayside equipment determines the resonant frequency of the train coil and energizes a corresponding relay. Since the resonant frequency of the coil carried on each train is known in advance, determination of this train coil resonant frequency identifies the train. When this system is used for OSing trains, the train coil is mounted on the caboose or last car of the train; identification of the coil thus indicates that the last car of the train has passed.

The following summary outlines the principal features provided in the system:

1. The equipment is energized only during intervals in which an OS is imminent.
2. The identification circuits are checked to verify that no identification exists or occurs in the system during the period immediately prior to the desired identification.
3. Transmission of indications is by standard coded signal circuit methods, providing protection against the effect of line crosses and other line faults.
4. Trains moving in the reverse direction cannot produce an OS indication.
5. The occurrence of an identification indicates that the entire train is out of the block.

By appropriate circuit and equipment arrangement, the system described can be extended to provide positive automatic OSing of trains for two-direction operation, with indication of direction of movement of trains.

Coded remote control system.

A new coded system known as "Syncrostep" is being used for controlling single remote control locations such as an interlocking. This system employs a principle of operation that is different from that used by any other coded system used in railway signaling. Other time code systems keep the office and field in step, or synchronism, by means of stepping relays driven by transmitted pulses. Syncrostep, however, keeps the office and field in synchronism by means of free oscillations of closely synchronized mechanical oscillators, one of which is located at each end of the line. This results in transmitting the control in about one second, and the indications in about two seconds.

In addition to the speed of operation, other advantages of the system are simplicity of apparatus and the resulting economy. There are no timing circuits and the code is created simply by the presence or absence of line current in the various steps. Only one type of standard quick-acting relay is used for coding.

The mechanical oscillator is a modification of the G.R.S. Type B oscillating code transmitter. The oscillators are normally energized and held against a stop. The rate is 270 cycles per minute, and synchronism is automatically maintained for the duration of each control and indication cycle.

With the Synchrostep system, either two or three line wires may be used to transmit controls and to receive indications. The two-wire system is called simplex operation, when controls and indications are transmitted one at a time. Controls and indications can be transmitted simultaneously by using three wires. This is termed duplex operation. Duplex operation can also be accomplished over two line wires by using conventional direct current for controls and carrier for the return indications.

Automatic retarder control system.

A system of retarder operation is in use which automatically controls cars to suitable speeds, subject to the supervisory control of a retarder operator. The retarder operator normally operates no levers or push buttons, but may modify final speeds, if desired, to refine the degree of control.

Weight and speed factors are integrated by the system to establish the proper control for each car or cut of cars. The weight factor is established directly and automatically by the cars. The speed factor is determined instantaneously and continuously while wheels are within reach of retarder brake shoes. The speed-determining and controlling equipment may be applied to existing retarders without modification of their mechanical structure.

Action Recommended

Acceptance as information.

NEW AND IMPROVED SIGNAL DEVICES AND RELATED
APPLIANCES*

It should be understood that this is solely a report to inform the members of the availability of the various devices mentioned therein, and what the manufacturers claim they will do. It is submitted as information and does not constitute any Signal Section recommendation.

Inductor test set.

A portable inductor test set has been developed for testing the wayside inductors used in the Union Switch & Signal intermittent inductive automatic train stop system. In this system it is essential to the safe operation of trains that the coils of the wayside inductor be connected properly, that they have no short-circuited turns, and that there be very high leakage resistance between coil terminals or between the wires connected to these terminals. This inductor test set has been designed to provide a reliable and convenient means for periodically testing the inductors. It operates by using a neon tube as an indicator to measure the self-induced voltage created by a single interruption of the current through the coil. The actual indication of the condition of the inductor under test is detected by observing the indication provided by the neon tube.

This test set is a development of the Union Switch & Signal Division of the Westinghouse Air Brake Co.

* Previous report on this subject appears in A.A.R. Signal Section 1951 Proceedings, Vol. XLIX, p. 299.

Electronic code test set.

An electronic code test set has been developed to facilitate the installation and maintenance of continuous coded cab signal and continuous coded automatic speed control engine equipment. This test set is portable for use in checking engine equipment at terminal locations, or it can be used to provide a permanent departure test at appropriate locations. The instrument has been designed for use in conjunction with wire loops mounted either permanently or temporarily between rails, and also short rail circuits.

For the convenience of the inspector when he is in the engine cab or at some other point removed from the test set, a remote control switch can be connected to the instrument by means of a cable plug connected to a receptacle on the panel.

This test set is a development of the Union Switch & Signal Division of the Westinghouse Air Brake Co.

Position light dwarf signal.

A new position light dwarf signal, Style PL-4, has been introduced to furnish an improved longer range aspect. The new signal employs a 4-inch doublet lens optical system with a diffusing cover glass to give spread to the beam. The same cast-iron case as was used in previous position light dwarf signals has been employed and the new doublet lens optical assembly is interchangeable with the old single lens optics. The range and visibility of the new position light dwarf signal are considerably better than in the old single lens type signal.

This signal is a development of the Union Switch & Signal Division of the Westinghouse Air Brake Co.

Capacitor timing unit.

A capacitor timing unit for use as a snubbing device on a special DN-22A relay has been developed to provide long and accurately controlled drop-away retardation, particularly for delaying the starting of a railroad-highway grade crossing protection warning device for a predetermined time after the approach track section becomes occupied. It is known as the Style UT capacitor unit.

This unit consists of a group of selected electrolytic capacitors with the total capacity of the unit held within close limits. The capacitors are housed in metal containers of two sizes. The single width unit is $10\frac{21}{32}$ inches deep by $8\frac{13}{32}$ inches high and requires $2\frac{27}{32}$ inch shelf length. Units to provide 5, 10, 15, 20, 25, 30, 45 and 60 seconds drop-away time are available. The special DN-22A relay has a closely controlled drop-away value to further bring under control one of the factors affecting the drop-away time of capacitor snubbed relays.

This is a development of the Union Switch & Signal Division of the Westinghouse Air Brake Co.

Polarized relay for switch machine control.

A new plug-in type polarized relay, Style PNP-69, has been developed for the control of either high or low-voltage switch machines. This relay utilizes the improved polar armature structure of the PNP-54A and PNP-61A

polarized relays. It is essentially the same as the PNP-61A relay except that two magnetic heavy duty front neutral contacts have been provided which makes the PNP-69 relay 50 per cent wider than the PNP-61A relay and the PN-50B relay. The two magnetic heavy duty contacts are furnished to provide a complete double break of the switch motor circuit so as to secure the same immunity from grounds that is obtained by using the double break of the circuit to the switch control relay.

This relay is a development of the Union Switch & Signal Division of the Westinghouse Air Brake Co.

Biased neutral relay.

A new two-point plug-in biased neutral line relay, Style PN-50BA, has been introduced to furnish the plug-in equivalent of the DN-22A general purpose relay but with the addition of a magnetic bias for the armature. It can be obtained in the same resistances and operating characteristics as the DN-22A relay. The PN-50BA relay uses the same basic two-coil magnetic structure as is used for the PN-50BH relay and similarly is only furnished with 2F-2B independent contacts. It is the same size as the PN-50B plug-in biased neutral relay.

This relay is a development of the Union Switch & Signal Division of the Westinghouse Air Brake Co.

Rail contactor.

A new rail contactor has been made available for attachment to one rail of any standard section in the standard space between two ties. It is operated by the flange on car wheels and has a self-contained oil buffer and circuit controller. When attached to the rail at specified locations and used in pairs, it provides an effective means for detection of train speeds. Its use is also indicated for supplemental control of highway crossing protective devices in connection with conventional track circuits and for special applications where conditions prevent the use of conventional track circuits. The car wheel flange operates the device by riding over a steel spring member which operates a rotating shaft rather than a reciprocating plunger, thus permitting an effective seal against entrance of dirt and moisture into the buffer oil or the contact enclosure.

This contactor is a development of the Union Switch & Signal Division of the Westinghouse Air Brake Co.

Portable cab signal testing unit.

A portable cab signal testing unit for checking the sensitivity and operation of cab signal equipment is available. This device is intended primarily for use at locations where permanently installed test equipment is not available. A coding mechanism is included which provides for coding the output alternating current at 75, 120 and 180 rates. The desired code rate is selected by a switch on the front panel. This switch also has a position which provides for uncoded alternating current output.

This cab signal testing unit is a development of the General Railway Signal Co.

Portable code analyzer.

A code analyzer for testing wayside coded track apparatus is available. The analyzer provides standard code rates of 75, 120, and 180 per minute. In addition, test code rates of 105, 150 and 225 per minute are provided for checking the selectivity of decoding units. A built-in relay, driven by any of the code rates, can be adjusted for various "on" times as may be required for testing purposes. The analyzer can be used to check code transmitters, decoders, and the "on" time of any coding contacts. Neon test lights show the difference between a code rate being tested and the standard code rate generated in the analyzer.

This is a development of the General Railway Signal Co.

Weight detector and interferometer.

A weight detector and an interferometer have been developed for use in the General Railway Signal Co.'s automatic retarder control system.

The weight detector is a weight-sensitive unit, installed on the rail ahead of the retarder, which automatically determines a weight class for each car as the car wheels roll over the detector. This weight-class information is utilized in the system to establish the speed at which the car or cut of cars is to be released from the retarder.

The interferometer is a speed-measuring device which provides continuous and essentially instantaneous measurement of the speed of each car or cut of cars as it moves through the retarder. The interferometer uses a narrow beam of ultra-high-frequency radiation aimed through the retarder. This radiation is continuously emitted by a sharply directional antenna mounted in a completely enclosed housing installed between the rails close to the leaving end of the retarder. A portion of the radiated energy is reflected from any car or cut of cars approaching and moving through the retarder. By combining the original and reflected frequencies in suitable circuits, a speed-indication output is produced which the automatic retarder control system uses in establishing when the car has been retarded to the speed appropriate to the weight class determined by the weight detector.

These devices are a development of the General Railway Signal Co., and may be applied to any existing G.R.S. retarder system without modification of the retarder structure.

Action Recommended

Acceptance as information.

BATTELLE MEMORIAL INSTITUTE REPORT (SECTION VI—
SIGNALING) ON "A PRELIMINARY INVESTIGATION OF
THE POSSIBILITIES OF EXPANSION OF RAILROAD
ELECTRIFICATION IN THE UNITED STATES"

This report was assigned to Committee X for analysis to determine if it contained information which should be disseminated to the membership. After careful study and deliberation, it is the Committee's judgment that claims made in the report are without supporting data and without indication of proper knowledge of basic fundamentals necessary to safe and reliable signal operation.

It is understood by the Committee that some Member Roads have collaborated with engineers of the Battelle Memorial Institute and with electronic manufacturing concerns in making exploratory field tests relative to the proposed cab signal system without insulated rail joints, impedance bonds, line wires or wayside signals, and were unable to develop that any suitable equipment or system is available for inclusion in railroad signal systems. Furthermore, to the best of our knowledge, the proposed system could not comply with the requirements and requisites of the Signal Section, A.A.R., and would not meet the I.C.C. Rules, Standards and Instructions.

Action Recommended

Acceptance as information.

COMMITTEE XI—ELECTRONICS

Personnel

J. I. Kirsch, Chairman

E. F. Brown, Vice-Chairman

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A. J. Hendry	T. W. Wigton
J. M. Hesser	J. E. Freehafer**
J. E. Hillig	C. B. Shields**

F. H. Menagh†

Signal Section, A.A.R.:

The following outline of work has been assigned:

1. Revision of Manual.
2. Indexing signal literature.
3. Investigate and report on the use of electronic controls for railway signaling.
4. Report on electronic measuring apparatus applicable to railway signaling.
5. Principles of vacuum tubes, carrier systems and other electronic systems and devices.
6. Recommend basic design principles for electronic controls for railway signaling systems.
7. Investigate and report on the effects to both signal controls and communication when superimposing centralized traffic control circuits on existing dispatchers or other communication circuits, collaborating with Communications Section, A.A.R.
8. Electronic tubes for use in signal apparatus, recommendation to cover types and designations of tubes to meet various requirements.
9. Investigate and report on the use of electronic switches in lieu of electromagnetic relays.
10. Investigate and report on the attenuation of open wire pairs and of cable pairs at frequencies up to 75 kilocycles.

The Committee submits for consideration, reports on the following subjects††:

3. Radar-type speed indicator on hump.
Control of manual block signal by coded carrier.

* Deceased April 25, 1953.

** Consulting Member.

† Consulting Member from Communications Section, A.A.R.

†† Suggestions or criticisms should be submitted in writing to the Chairman of the Committee on or before August 28, 1953.

4. Electronic code test set.
Inductor test set.
 5. Elementary principles of carrier as applied to railway signaling.
 7. Applications of electric wave filters.
 9. Electronic switching circuits.
- Cooperative report. Communications Section, A.A.R., Committee 4—Radio and Allied Communications.



APPLICATIONS OF ELECTRIC WAVE FILTERS

The purpose of this report is to present a tabulation of the various filters used in electronic signal controls, giving their characteristics and applications.

In the 1949 Annual Meeting Advance Notice* Committee XI submitted as information a report entitled "Electronics as Applied to Railway Signaling." A section of this report dealt with the "electric wave filter," outlining the theory and operation of filters as used in signaling practice. The report herein augments the former report by covering specific filters now available and the uses being made of them.

In addition to modifying the amplitude of a transmitted wave, a filter also produces a phase shift which depends on frequency. With most signal systems this effect is generally unimportant, and therefore will not be covered in this report.

The ability of a filter to pass certain frequencies and attenuate others is shown for each filter considered by means of a graph to show the reader, at a glance, the ability of the filter to pass certain frequencies.



Fig. 1.

Block Diagram of a Filter.

Taking the filter shown in Fig. 1 as an example of an ideal filter, the graph, Fig. 2, explains its transmission characteristics.

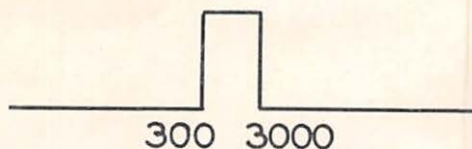


Fig. 2.

Transmission Characteristics of an Ideal Band Pass Filter.

The numbers 300 and 3,000 refer to the frequency in cycles per second and represent the limits of the band of frequencies which are freely transmitted through the filter from line 1 to line 2 or from line 2 to line 1. The lower lines of the graph represent the region in which no power can be transmitted in either direction and the higher line represents the region in which power is readily transmitted through the filter.

Another important characteristic of filters is whether or not they affect the line at frequencies outside the range for which they are responsive. If, for

* A.A.R. Signal Section 1948 Proceedings, Vol. XLVI, pp. 385 and 500.

example, a filter is designed to pass frequencies between 300 and 3,000 cycles, it is desirable that this filter should not load the line outside this range. Thus, each line for frequencies below 300 and above 3,000 cycles per second should function as if the filter were not there.

In the tabulation of filters, appearing on pages 208 and 209, all the filters have the desirable characteristic that they do not load the line at the frequencies outside the frequency range. Even within the frequency pass band none of the filters listed load the line appreciably except those marked with an asterisk (*). These filters short circuit the line only at the defined frequencies.

A third property of a filter is that of its "longitudinal balance." If a filter is not longitudinally balanced it will cause the line to which it is connected to be susceptible to foreign induced voltages commonly referred to as "noise." As an example, refer to Fig. 3 which is an unbalanced band pass filter.

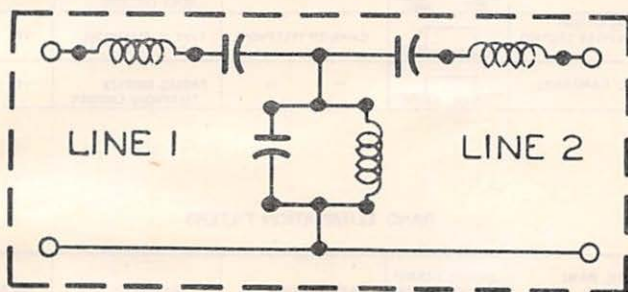


Fig. 3.

Unbalanced Band Pass Filter.

It can be seen that the top wire does not look the same as the bottom wire and, therefore, foreign induced currents will flow in different amounts longitudinally in the two wires.

The filter shown in Fig. 4 has the same operating electrical characteristics as the filter in Fig. 3 but both top and bottom longitudinal circuits are identical and no unbalanced currents can flow. This prevents introduction of noise by longitudinal induction.

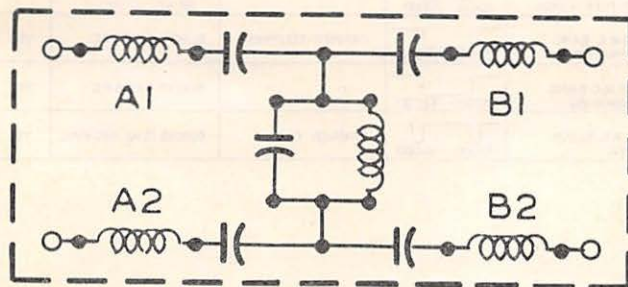
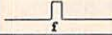
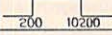
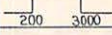
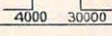


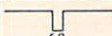
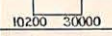
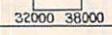
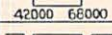
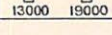
Fig. 4.

Balanced Band Pass Filter.

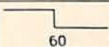
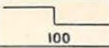
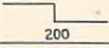
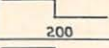
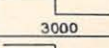
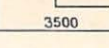
BAND PASS FILTERS

SPECIFIC NAME OF FILTER	SERIES TRANSMISSION GRAPH (FREQUENCY)	APPLICATION	REMARKS	BALANCED
SINGLE CHANNEL RECEIVING FILTERS		RECEIVING FILTER FOR CARRIER CTC	FREQUENCY SELECTION. AND 'f' FROM 6.0 TO 44.0 K C	YES
SINGLE CHANNEL TRANSMITTING FILTER		TRANSMITTING FILTER FOR CARRIER CTC	IMPEDANCE PROTECTION ANY 'f' FROM 6.0 TO 44.0 K C	NO
VOICE AND TYPE H PASS		CTC & TELEPHONE	BLOCKS D.C. AND CARRIER FREQUENCIES ABOVE 10.2 K C	YES
VOICE PASS		TELEPHONE	TO JOIN TWO LINES FOR VOICE CIRCUITS	YES
WE 65C OR 66A HIGH PASS SECTION		CARRIER TELEPHONE	TYPE H TELEPHONE	YES
35 K C BAND PASS.		" "	PASSES SIMPLEX TELEPHONE CARRIER	YES

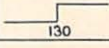
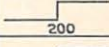
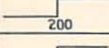
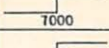
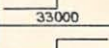
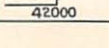
BAND ELIMINATION FILTERS

SPECIFIC NAME OF FILTER	SERIES TRANSMISSION GRAPH (FREQUENCY)	APPLICATION	REMARKS	BALANCED
60 CYCLE * SHUNT		D.C. CTC LINES	TO SHUNT ANY FOREIGN 60 CYCLE CURRENT	YES
100 CYCLE * SHUNT		" " "	TO SHUNT ANY FOREIGN 100 CYCLE CURRENT	YES
100 CYCLE BLOCK		" " "	BLOCKS 100 CYCLE	YES
100 CYCLE BLOCK AND SHUNT			BLOCKS 100 CYCLE	YES
13 K C BLOCK		CARRIER CTC	BLOCKS 13 K C	YES
SPECIAL D.C. VOICE AND TYPE H PASS		" "	BLOCKS CARRIER TO 30 K C	YES
32-38 K C BAND ELIMINATION		CARRIER TELEPHONE	BLOCKS 32-38 K C	YES
42-68 K C BAND ELIMINATION		" "	BLOCKS 42-68 K C	YES
13-19 K C BLOCK FILTER		CARRIER CTC	BLOCKS 13 K C AND 19 K C	YES

LOW PASS FILTERS

SPECIFIC NAME OF FILTER	SERIES TRANSMISSION GRAPH (FREQUENCY)	APPLICATION	REMARKS	BALANCED
60 CYCLE TUNED ALTERNATOR OUTPUT		WITH TUNED ALTERNATOR	WAVE FORM CORRECTION	NO
100 CYCLE TUNED ALTERNATOR OUTPUT		" " "	" " "	NO
DC PASS		CARRIER OR DC CTC	TO SHUNT DC AROUND CARRIER REPEATER	YES
FIELD CODE FILTER		" " "	PREVENTS FIELD UNIT INTERFERING WITH PHONE OR CARRIER	YES
TELEPHONE REACTOR		CARRIER CTC & PHONE	PREVENTS PHONE FAULT AFFECTING CTC CARRIER	YES
DC & VOICE PASS		CARRIER CTC	BLOCKS CARRIER (OPEN LINE)	YES
WE 85C OR 86A LOW PASS SECTION		TYPE H CARRIER PHONE	PASSES VOICE FREQUENCIES	YES

HIGH PASS FILTERS

SPECIFIC NAME OF FILTER	SERIES TRANSMISSION GRAPH (FREQUENCY)	APPLICATION	REMARKS	BALANCED
MATCHING TRANSFORMER		CTC AND TELEPHONE	MATCHING LINES AND AS H.P. FILTER	YES
DC BLOCK		SPECIAL	BLOCKS DC	NO
TELEPHONE FILTER		CTC AND TELEPHONE	PREVENTS PHONE FAULTS AFFECTING DC, CTC LINES	YES
CARRIER PASS		CARRIER CTC	PASSES FREQUENCIES ABOVE 7 K C	YES
33 KC HIGH PASS.		CARRIER-TELEPHONE	PASSES FREQUENCIES ABOVE 33 K C	YES
42 KC HIGH PASS.		" "	PASSES FREQUENCIES ABOVE 42 K C	YES

A further improvement often incorporated in modern filters is made by winding coils A1 and A2 on the same iron core and B1 and B2 on another iron core.

Filters are designed to match a characteristic of the associated line and load known as "characteristic impedance." In the application of filters consideration must be given to the characteristic impedance.

Action Recommended

Acceptance as information.

ELECTRONIC SWITCHING CIRCUITS

In the 1949 Annual Meeting Advance Notice*, there was published a description of the electron tube and its application to a number of common circuits. In all the applications described, the current through the anode circuit is made to follow variations in the potential of the control grid. As the grid potential changes, the anode current ranges between zero and the maximum which the tube can conduct under the existing circuit conditions. At any instant, the tube may be "non-conducting," "partially conducting in various degrees," or "completely conducting."

There is another class of circuits, however, in which, except for brief transition intervals, a tube is either non-conducting or completely conducting. It can be in just one of two stable states. Similarly, a single-throw switch has but two states: it can either be open or closed. By analogy, tube circuits in which the tube is either "on" or "off" are called "switching circuits." These circuits are of interest because they can be made to perform many of the functions of high-speed relays. While these applications are not common in railway signal practice, they have been widely accepted in the fields of radar, telemetering and high-speed digital computers. It is anticipated that these techniques will become increasingly important in signal applications where the density of traffic and close headways place a premium on the speeds of signaling systems.

In explaining the action of a simple switch circuit it will be useful to consider an example in which specific values of the circuit components are used. Figure 1A shows a triode, V_1 , assumed to be one-half of a 6SN7, connected in a circuit in such manner that the tube is conducting. Voltages shown are referred to the potential of the cathode, which is arbitrarily taken as zero.

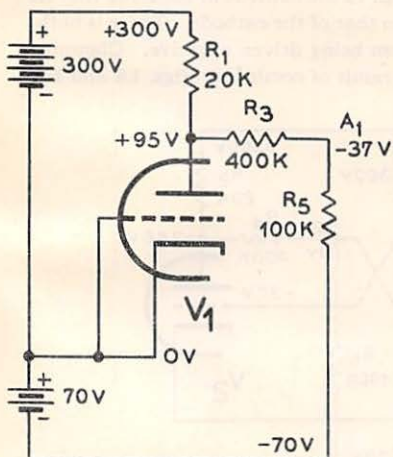


Fig. 1A.
Triode, Conducting.

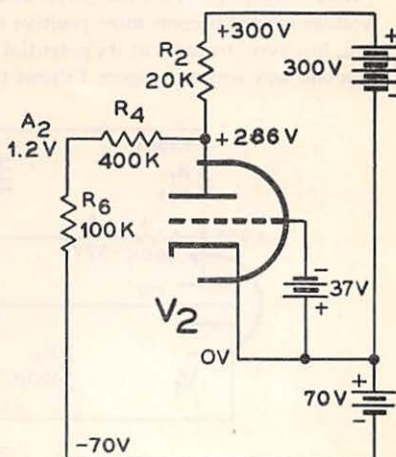


Fig. 1B.
Triode, Non-Conducting.

* A.A.R. Signal Section 1948 Proceedings, Vol. XLVI, pp. 385 and 500.

The symbol K, used to specify resistance values, is an abbreviation for 1,000 ohms. Thus $20K = 20,000$ ohms. The grid is connected to the cathode to make the tube completely conducting and the resistance R_1 limits the current through the tube.

Note that whereas the plate supply potential is 300 volts, the plate potential is 95 volts, the difference being caused principally by the drop produced by the plate current flowing through R_1 . The point A_1 is 37 volts below the cathode potential.

Consider next the circuit of Fig. 1B, in which V_2 , the other half of the $6SN7$, is so connected that it is carrying no appreciable plate current, *i.e.*, is non-conducting. For a 300-volt plate supply voltage, a $6SN7$ will be essentially non-conducting if the grid potential is more than 18.5 volts negative in respect to its cathode. This is called the cut-off potential. In the example, the potential of the grid of V_2 is maintained at minus 37 volts by a battery and the tube is accordingly cut-off. Note that the plate potential of the cut-off tube is 286 volts. The difference between this value and 300 volts, the plate supply value, is caused by a small current that flows through R_2 , R_4 and R_6 to the negative side of the 70-volt battery. The voltage divider network R_2 , R_4 and R_6 maintains point A_2 at plus 1.2 volts.

Next let the circuits of Figs. 1A and 1B be combined by removing the 37-volt battery of Fig. 1B and connecting the grid of V_2 to point A_1 of Fig. 1A. The grid of V_2 thus is still held at a potential of minus 37 volts, which is below the cut-off value of minus 18.5 volts, and the tube remains non-conducting. Similarly, let the grid of V_1 be disconnected from its own cathode and connected to point A_2 . Since the potential of A_2 is positive, V_1 will continue to conduct. When a grid is positive it draws current and this current in turn causes drops in the resistances in the circuit so that the grid assumes very nearly the potential of its cathode. Hence A_2 will drop to zero potential. This action is called "clamping," *i.e.*, the grid is clamped to the cathode in the sense that its voltage cannot become more positive than that of the cathode. There is nothing, however, to prevent its potential from being driven negative. Clamping is a one-way action. Figure 2 shows the result of combining Figs. 1A and 1B.

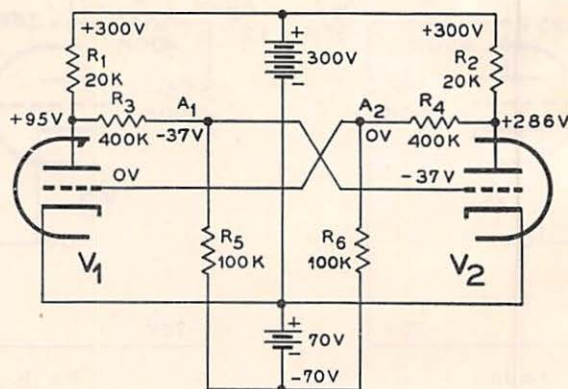


Fig. 2.

Circuits Combined to Form Switching Circuit Having Two Stable States.

The interesting feature of the combination circuit is that it has two stable states, just like a toggle switch or relay. A toggle switch can be thrown either to the right or to the left. It will not stay in any intermediate position. Similarly a neutral relay can be either up or down, but cannot remain in between. The circuit of Fig. 2 can have either V_1 conducting (as shown) or V_2 conducting, but not both tubes conducting at the same time. This is clear from the fact that when V_1 is conducting, its plate is at relatively low potential and consequently point A_1 and the grid of V_2 are below cut-off. In other words, when V_1 conducts it holds V_2 cut-off. Conversely, when V_2 is non-conducting its plate is at relatively high potential, and consequently point A_2 and the grid of V_1 are above cut-off. This condition maintains V_1 in the conducting state. From what has been said, it follows directly that if V_2 had been assumed to be conducting, then V_1 would be non-conducting because its grid would be held below cut-off by the low potential of the plate of V_2 .

Just as a toggle switch can be made to snap from one position to the other by the application of sufficient force, so can the circuit of Fig. 2 be made to switch from one state to the other by the introduction of an appropriate voltage pulse. Suppose that a voltage pulse is applied from an external source (not shown) that temporarily reduces the current flowing through V_1 . This reduction of current reduces the drop through R_1 and raises the potential of the plate. Because R_3 is connected to the plate of V_1 , the potential of point A_1 , and also that of the grid of V_2 , are raised. If the original pulse is of sufficient magnitude, the potential of the grid of V_2 can be raised above cut-off and V_2 will begin to conduct. When V_2 conducts, the potential of its plate decreases because of the increased drop in R_2 . Thus the potential of point A_2 and of the grid of V_1 are reduced. The reduction of the potential of its grid further decreases current through V_1 and further raises the potential of its plate. This increase in potential is transmitted to the grid of V_2 which is made to conduct still more strongly. This action, which actually takes place extremely rapidly, continues until V_2 is completely conducting and V_1 is completely cut off. It is, of course, possible to switch back to the original condition by applying a suitable voltage pulse to reduce the current through V_2 .

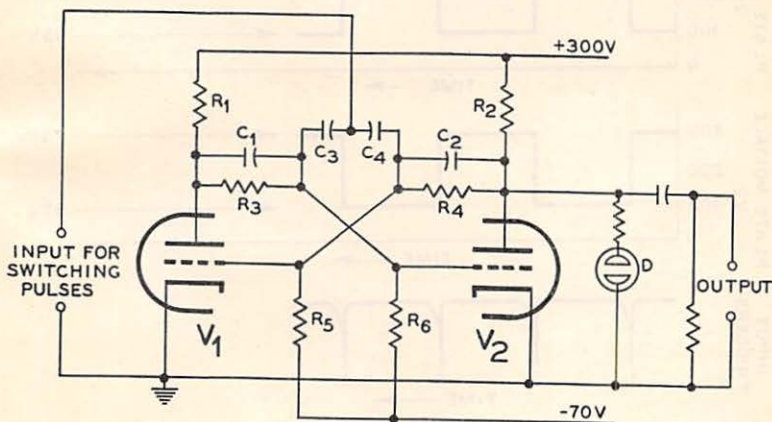


Fig. 3.

Scale-of-Two Counter.

To improve the operation of the circuit by making it more sensitive to rapid changes in potentials, capacitors are usually connected across R_3 and R_4 . If, in addition, a way of applying switching pulses is provided by means of coupling capacitors, C_3 and C_4 , as shown in Fig. 3, the circuit becomes what is called a "scale-of-two counter."

The action of this circuit is as follows: a series of sharp negative pulses (or triggers) is applied to the input terminals from an auxiliary circuit (not shown). Each trigger causes the circuit to change state. If it is assumed that V_1 is initially conducting and that V_2 is non-conducting, then the first trigger will render V_1 non-conducting and V_2 conducting. The second trigger will restore the original condition, *i.e.*, V_1 conducting and V_2 non-conducting. Thus, after every odd-numbered trigger, V_1 will be non-conducting and V_2 will be conducting and after every even-numbered trigger V_1 will be conducting, and V_2 non-conducting. Every two pulses carry the circuit through a complete cycle. By adding a glow tube D from plate to cathode of V_2 , as shown in Fig. 3, the circuit can be made to indicate visually whether an even or odd number of pulses has been supplied to it. Thus after an even number of pulses V_2 is non-conducting, its plate voltage is high, and the tube D glows. Conversely, after an odd number of pulses, V_2 is conducting, its plate voltage is low, and the tube D is extinguished.

The voltage wave forms associated with Fig. 3 are shown in Fig. 4. The triggers are applied at equal intervals as shown on the lower line. The plate voltages at corresponding times are shown on the two top lines. Note that when a tube is non-conducting, its plate voltage is high (286 volts) and when it is conducting its plate voltage is relatively low (95 volts). Whenever V_2 changes from non-conducting to conducting, its plate voltage falls and a negative trigger is produced at the output terminals. From Fig. 4, it is evident that this condition occurs on the first, third and all odd-numbered

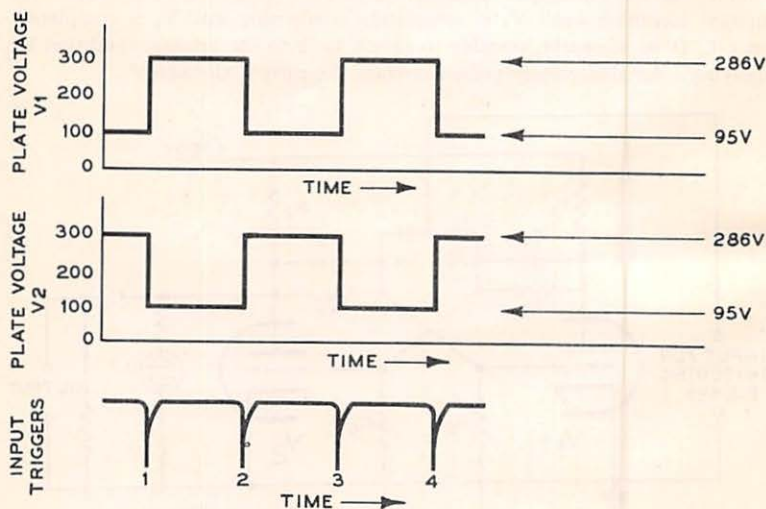


Fig. 4.

Voltage Wave Forms.

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triggers. Thus the circuit produces one negative output pulse for every two input pulses. Used in this way, the circuit becomes a frequency divider, the output frequency being one-half the input frequency.

Single counter stages can be cascaded to form counter chains by connecting the output of one stage to the input of the following stage. A two-stage counter, obtained in this way, produces one negative output pulse for every four input pulses, *i.e.*, the counter divides the input frequency by four. Similarly, chains of three, four and five stages divide the input frequency by 8, 16, and 32. Arrangements of this kind are frequently used to count pulses which occur too rapidly to operate mechanical counters. Thus, for example, if a mechanical counter is connected to the output of a five-stage chain, it responds only to every 32nd pulse applied to the input of the chain. The output pulses may, therefore, occur at a sufficiently low rate for mechanical counting while the original rate, 32 times as high, may be much too fast.

Counter chains can be used to indicate directly the number of input pulses received. A single stage can count up to one as it has two stable states and changes from one to the other when a trigger is applied. This is shown in Table I.

TABLE I

No. of pulses applied	State of circuit
Initial state	V_1 conducting
1	V_2 conducting

Similarly, a two-stage combination can count up to three since it has four stable states and changes states in response to each pulse.

TABLE II

No. of pulses applied	State of circuit	
	State 1	State 2
Initial state	V_1 conducting	V_1 conducting
1	V_2 conducting	V_2 conducting
2	V_1 conducting	V_2 conducting

In the same way, three stages can count to seven; four, to fifteen; *i.e.*, n stages can count $2^n - 1$.

As the glow tubes indicate the state of each stage, it is possible to read the count at any instant by observing the combination of illuminated lamps. This arrangement, however, would be inconvenient as considerable skill would be necessary to interpret the pattern in terms of our ordinary decimal system of counting. It would be more convenient if the indicator lamps were numbered 1, 2, 3, 4, etc., in sequence, and the circuit so arranged that the light whose number corresponds to the count is the only one illuminated. This can be done. The synchrograph (see A.A.R. Signal Section 1950 Proceedings, Vol. XLVIII, pp. 337 and 399), used to measure small time intervals, is an example of a direct reading indicator that employs chains of scale-of-two counters.

The circuit of Fig. 3 can be modified in a number of useful ways. If the resistors R_3 and R_4 and the trigger input circuit are omitted, and the resistors R_5 and R_6 are connected to the cathode bus, the circuit becomes the Eccles-Jordan multivibrator circuit shown in Fig. 5. When V_1 conducts, it holds V_2

cut off by means of a charge on the capacitor C_1 . This charge, however, leaks off through V_1 and R_6 , and after a time the grid of V_2 rises above cut-off. When this happens, V_2 conducts and, by a switching action similar to that described for the scale-of-two counter, cuts off V_1 . But V_1 is held cut off because of the charge on C_2 , and when this charge leaks off through V_2 and R_5 , V_1 conducts once more and cuts off V_2 . The action is then repeated. Thus V_1 and V_2 conduct alternately, the switching rate being determined primarily by the values of the products C_1R_6 and C_2R_5 . The wave form of the plate voltages will be rectangular and similar in appearance to those represented on the upper two lines of Fig. 4. Rectangular wave forms find many applications in electronics. For example, they are frequently used to "gate" auxiliary circuits "on" and "off."

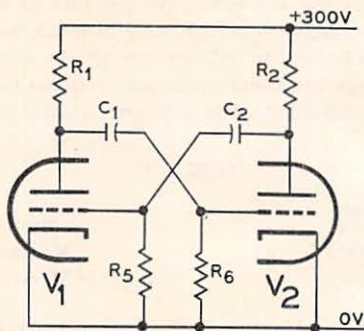


Fig. 5.

Eccles-Jordan Multivibrator.

Another variation of the basic Eccles-Jordan counting circuit is shown in Fig. 6. This is the one-shot multivibrator circuit, or "flip-flop." Tube V_1 is normally conducting because its grid is connected by resistor R_7 to the 300-

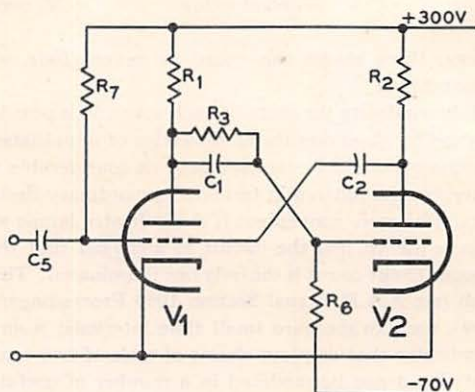


Fig. 6.

Eccles-Jordan Flip-Flop.

volt plate supply bus. When V_1 is conducting, it holds V_2 cut off. If a negative trigger is now applied at the input, the grid of V_1 can be driven below cut-off. When this happens, V_2 conducts and holds V_1 cut off. However, V_2 is able to hold V_1 off only as long as a charge remains on the coupling capacitor C_2 . Before this charge has been completely dissipated, the grid of V_1 rises above cut-off and V_1 once more conducts. The circuit then remains in its normal condition with V_1 conducting and V_2 cut off until another trigger is applied. The circuit gets its name from the fact that a trigger "flips" it into one state and then the circuit "flops" back into its original state.

The basic circuits described find wide application in services which require high-speed switching operations. They are seldom used alone, but in combination with other circuits they provide the building blocks out of which have been constructed the complex electronic systems upon which modern technology depends.

Action Recommended

Acceptance as information.

RADAR-TYPE SPEED INDICATOR ON HUMP

A new development used experimentally at John Sevier and Ernest Norris Yards of the Southern Ry. is a speed indicator. From it an indication of the speed of each freight car approaching a retarder is received in the control tower.

The device employs the principle of radar. It consists of a radio transmitter which transmits an unmodulated 2,455 megacycle signal continuously. When the signal from the transmitter encounters an object, it is reflected back to the receiver. The receiver for the unit is mounted on the same chassis as the transmitter and some of the original signal from the transmitter is picked up by the receiver. If the object from which the signal is reflected is moving, "Doppler effects" cause an increase or decrease in the frequency of the reflected signal. The frequency change in this case is 7.5 cps per mile per hour. The receiver now has two frequencies impressed on its antenna circuit. These are heterodyned and fed through a frequency sensitive circuit to a meter calibrated in miles per hour. Since the frequency of the heterodyne signal is the difference between the frequencies of the transmitted and reflected signals, it is proportional to the speed of the car and, therefore, the meter reading is an indication of the speed. In order to detect the speed of cars in a particular area, beamed transmission is employed.

Considerable experimentation was required before these instruments were properly located and adjusted. As finally located, the transceiver part of each speedmeter is mounted in a weatherproof cast-iron housing having a plexiglass window for radiation purposes. The housing is mounted on a concrete base, half way between two final retarders, 6 feet from the trailing end of the retarder and facing up the hump. The antennas are at approximately track level. Each speedmeter serves two retarders.

Two speed indicators are used with each meter. One is in the cast-iron housing along with the transceiver. The other is mounted on the retarder control machine so the retarder operator can determine the speed of the car or a cut of cars merely by looking at the meters mounted in the control panel in front of him. The meters have the appearance of automobile speedometers and indicate the instantaneous car speed in miles per hour.

The experience of the Southern Ry. indicates this device is especially useful during periods of poor visibility.

This is a development of Automatic Signal Division of Eastern Industries, Inc.

Action Recommended

Acceptance as information.

CONTROL OF MANUAL BLOCK SIGNAL BY CODED CARRIER

A system has been developed for remote control of a manual block signal, with provision for indicating the signal aspect. Carrier is employed for transmission of controls and indications, and the system may therefore be used with a two-wire line already installed for other purposes, such as centralized traffic control, without interfering with the primary use of the line.

Figure 1 is a block diagram which shows how the system is arranged. The signal control lever at the control office may be turned to any one of the three positions: "R" (red), "Y" (yellow) or "G" (green), corresponding to the three aspects of the manual block signal. When the lever is at "R," a 75 code transmitter is selected; when the lever is at "Y," a 120 code transmitter is selected; when the lever is at "G," a 180 code transmitter is selected.

The code transmitter selected by the control lever codes a carrier transmitter which delivers a suitable carrier frequency (carrier A) to the line, coded at the corresponding rate.

At the field location carrier A is received by the carrier A control receiver, which operates the field line relay. This relay is normally energized, *i.e.*, front contacts closed, when carrier A is not being received. When carrier A appears on the line, the field line relay armature drops. Since the control codes are made up of equal intervals of carrier "on" and carrier "off," reception of a control code causes the field line relay to operate at the code rate transmitted on carrier A. Contacts on the field line relay (the lower set of contacts as shown in Fig. 1) excite a master transformer, the output of which is fed to conventional decoding equipment. The decoding equipment, in turn, controls the signal control relay to produce the desired signal aspect.

A separate contact on the field line relay (the upper contact in Fig. 1) codes the indication transmitter, which generates carrier B at a frequency different from carrier A. Since the field line relay is operating at the control-code rate, carrier B is coded at the same rate. The indication coding circuit carrier B is controlled by an agreement-circuit network which checks that only one of the signal control relays is energized and that the signal is displaying the corresponding aspect.

As indicated in Fig. 1, carrier B transmitter is coded by a front contact to the field line relay. Since this relay is de-energized when carrier A is being received, carrier B is not transmitted when carrier A is on the line, and vice versa. When carrier A is coded, carrier B appears on the line, coded at the same rate, during the "off" periods of the control code.

Carrier B is received at the control office by the indication receiver. This receiver operates the office line relay in a manner similar to the operation of the field line relay by the control receiver, *i.e.*, this relay is energized when carrier B is not being received. When carrier B appears on the line, the relay releases.

From the foregoing, the following summary of relay action may be made: (1) closing of the front contact on a code transmitter at the control office impresses carrier A on the line; (2) appearance of carrier A at the field location causes the field line relay to release; (3) releasing of the field line relay removes carrier B from the line; (4) removal of carrier B from the line causes the office line relay to pick up. When the front contact of the code transmitter opens,

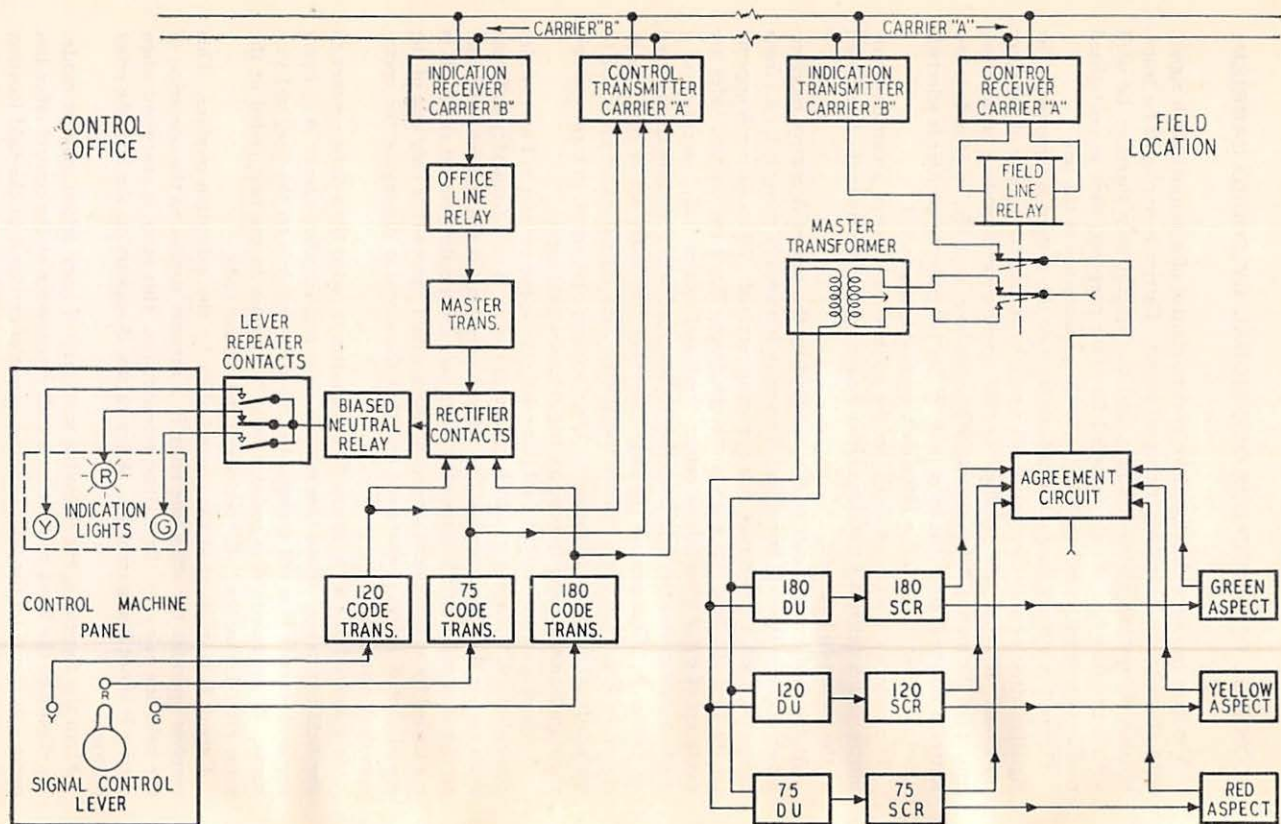


Fig. 1.

Block Diagram of Remotely-Controlled Manual Block Signal System.

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these conditions are reversed and the office line relay releases. The condition is thus established that the office line relay follows the code transmitter, *i.e.*, closes and opens its front contact essentially in synchronism with the code transmitter except for the very small delay time associated with the transmission of the two carriers and the operation of the line relays.

The office line relay is used to excite a master transformer, the output of which is rectified by contacts of the code transmitter in operation at that time. The rectified output then energizes a biased neutral relay, the picking up of which permits the display of the indication light corresponding to the position of the signal control lever, provided that the aspect of the signal continues to agree with the position of the lever.

The blocks in the diagram marked "rectifier contacts" and "biased neutral relay" include the circuits associated with the rectification of the output of the master transformer. These circuits prove the existence of the desired field aspect since the required rectification cannot take place unless the office line relay is operating at the same rate as the code transmitter, and is in step with the code transmitter. Rectification of the proper polarity takes place when the front contact of the code transmitter and the front contact of the office line relay are closed simultaneously (in phase). If carrier A were operating the office line relay, these contacts would be out of phase, the rectified current would be of the wrong polarity, and the armature of the biased neutral relay would not be picked up. Thus only carrier B is effective in picking up the biased neutral relay. Since carrier B can be transmitted only when the signal aspect agrees with the control code, the presence of carrier B, coded at the control rate, proves that the signal aspect agrees with the control code. Therefore, the lighting of the corresponding indication light at the control office is a continually checked indication of the aspect being displayed by the remotely controlled manual block signal.

This is a development of General Railway Signal Co.

Action Recommended

Acceptance as information.

ELEMENTARY PRINCIPLES OF CARRIER AS APPLIED TO
RAILWAY SIGNALING

The term "carrier" suggests different things to different people. To the design engineer it means opportunity to combine many functions on one circuit, and is commonly done with c.t.c. controls, or even to accomplish the otherwise impossible, as is true of radio. To the layman it may mean just a designation for a mysterious device not intended to be understood by other than experts. Fundamentally, carrier is not mysterious and a few simple analogies should make it evident that its principles can be understood by anyone having a reasonable knowledge of signaling.

Centralized control of switches and signals is extensively used on American railroads, and an appreciable proportion of these installations depends on carrier operation. A centralized traffic control system is essentially a group of interlockings. All necessary safety features required by standard signaling practices are provided locally. The remote control circuits are merely devices for advising the local equipment that certain switches and signals should operate provided such operation is consistent with safety requirements and local conditions, and for reporting existing conditions at outlying points.

It is obvious, therefore, that the remote control circuits are nothing more nor less than telegraph circuits which request, but do not necessarily require, certain switch and signal operations, and which function in the opposite direction to report, solely for information, conditions in the field. The simplest and most obvious way of accomplishing this would be to provide an individual line circuit for each function. A control circuit might consist of a battery and a simple "on-off" switch at the control point, and a relay at the field location. An indication circuit would comprise a pair of relay contacts in the field, a lamp or other indicating device at the control point, and necessary battery. From an operating standpoint such an arrangement is entirely satisfactory and meets every requirement. Where distances are short, or number of functions small, circuits such as these are not uncommon.

As distance or number of functions increase, the cost of line circuits rises and soon reaches a point at which direct controls cannot be economically justified. It then becomes necessary to find ways to concentrate two or more circuits on one wire or pair of wires. One way to accomplish this would be the utilization of two battery polarities at the control end of the circuit and polarized relays at the field location. Such an arrangement permits the handling of two controls over one circuit. But even this doubling of circuit efficiency falls far short of meeting the requirements of many installations. It was the need of multiple-control equipment that brought forth the coded type of c.t.c. control. Codes are combinations of impulses not too different from telegraph codes that serve, like telegraph codes, to identify the called or calling stations and to transmit the desired information to and from the control point. The coding and decoding operation is, of course, automatic.

For many installations direct current code equipment adequately serves the purpose of permitting numerous functions to be handled over a single pair of wires, but for other installations there may be limitations, such as:

1. A practical limit on the number of available code combinations, prohibiting the placing of a large number of stations on one line.

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2. Time required to transmit codes is a minor item for any one code, but delay in handling codes in heavy traffic zones may become an appreciable item.
3. Leakage, resistance, and other line characteristics limit the length of line over which direct current impulses may be transmitted reliably.

It is apparent, therefore, that means for extending the effective length of circuits and providing for simultaneous transmission of two or more codes would be highly desirable. Carrier does both of these and it is for these reasons that it has become a valuable adjunct to other signal methods.

Having given consideration to why carrier is needed and how it can be used, the question arises as to what carrier is. Essentially it is nothing more nor less than an alternating current. An alternating current constantly reverses its polarity. Each time it changes from positive to negative and back to positive it goes through one complete cycle. The term "frequency" denotes the number of cycles occurring in a given period of time, usually one second. For example, the frequency of most commercial power systems is 60 cycles per second. Although not generally thought of as such, an a.c. coded track circuit is a carrier. An alternating current is applied to the rails and is interrupted to form a series of on-off periods. The basic frequency may, for example, be 60 cycles per second interrupted at the rate of 3 cycles per second. Such a circuit would be closed for $\frac{1}{6}$ second, or long enough to permit 10 cycles of the 60-cycle-per-second current to flow. The circuit would then be open for an equal length of time, and then closed for another $\frac{1}{6}$ second. This is the timing sequence of the familiar 180 (per minute) or "clear" code.

A similar arrangement is applicable to centralized traffic control circuits whereby the coding contacts open and close the alternating current supply to produce the desired pattern of long and short impulses. But why do this with alternating current instead of direct current? With alternating current a wide range of frequencies is available for an almost unlimited number of code systems. Fortunately, devices are available which permit combining frequencies on a line and then separating, or picking off, the desired frequency at any location. Such devices are known as "filters."

A complete explanation of how a filter performs its work would be lengthy and quite involved. A simple analogy, however, might help in understanding what filters do, even though it does not explain just how it is done. Everyone is familiar with clock pendulums. A pendulum, like an alternating current wave, swings in one direction, then reverses itself and swings in the opposite direction to complete a cycle. The frequency, or rate at which the pendulum swings, is governed by its length. As the pendulum is made shorter in length the time required to complete a cycle is decreased and the frequency is correspondingly increased. For any given length the pendulum has a natural frequency.

Even though a pendulum has a natural period, or frequency, it can be made to swing at any other rate either faster or slower. Faster motion can be produced by pushing the pendulum and slower motion results when force is applied to hold the pendulum back. In either case additional force is required to cause the pendulum to swing at other than its natural rate. It also follows that if the force driving the pendulum is not increased, but is applied at some frequency other than the natural frequency of the pendulum, the amplitude,

or length of swing, of the pendulum will be materially reduced, even to an almost complete stop.

An electrical filter behaves just like a pendulum. The filter has a natural frequency at which it oscillates most readily and this frequency is determined by choosing the proper values of inductance and capacity. Like the pendulum the filter offers high impedance to alternating currents of a frequency differing from its natural frequency. It should be remembered that a filter does not actually cut off unwanted frequencies. All the frequencies in a circuit pass through the filter, but the unwanted frequencies are so greatly attenuated, or diminished, that for most practical purposes they are negligible. A relay connected to a line through a filter of the proper frequency characteristics may respond to a given voltage on the line with a wide operating margin. An equal line voltage of another frequency may produce a current through the filter $\frac{1}{100}$ of that of the wanted frequency. This latter current would be far too small to operate the relay. Current of the unwanted frequency is therefore present in the relay winding, but its value is so small that it is non-existent so far as relay operation is concerned.

With these principles in mind the fundamental design of a carrier control system is relatively simple. If it is desired to operate a number of different controls over one pair of line wires, an alternating current of a different frequency for each control can be provided, each one controlled over the contacts of a centralized traffic control code relay, with properly tuned filters at the distant locations; then each distant relay will respond to a selected frequency and to no other. The limitations of a simple d.c. code circuit have thus been overcome in that an almost unlimited number of codes can be transmitted simultaneously over one pair of wires and at the same time provide a system which largely overcomes the limitations of distance imposed on d.c. circuits. The alternating currents of carrier circuits are readily amplified by vacuum tube repeaters. These devices can be inserted in the line at intervals to restore the carrier currents to their original level for transmission on to the next repeater. A corresponding "regeneration" of d.c. impulses can be accomplished only by the use of rather complicated equipment.

Viewed from the standpoint of fundamentals involved and results to be accomplished, carrier is not too difficult to understand. There are, of course, many applications of carrier that are somewhat involved, but the complex and varied applications need not confuse the signalman who wants to know something of the fundamentals as applied to railway signaling.

Action Recommended

Acceptance as information.

ELECTRONIC CODE TEST SET

An electronic code test set has been developed to facilitate the installation and maintenance of coded cab signal and coded automatic speed control engine equipment. This test set is portable for use in checking engine equipment at terminal locations, or can be used to provide a permanent departure test at appropriate locations. The instrument has been designed for use in conjunction with wire loops mounted either permanently or temporarily between rails, and also short rail circuits.

The test set operates from a 110-volt 60-cycle input and delivers an output current at the required test frequency with facilities for interrupting the output current at a rate of 75, 120, or 180 cycles per minute. The output terminals may be directly connected to the track circuit or track loop, eliminating the necessity for an intermediate transformer. The instrument will deliver a maximum of 15 watts to the track circuit terminals.

The electronic test set includes an electronic alternator (oscillator) which generates the test current at the required frequency. The value of this current can be controlled by the "track current adjustment" knob, and is indicated on the panel ammeter.

Also included as part of the test set is a 15 r.p.m. split-phase reducer motor, which drives a cam shaft actuating contacts which operate at 75, 120 and 180 cycles per minute. These contacts interrupt the current at the prescribed code speed and are selected by means of the "code selector" switch. The current can be made steady either by means of the "code selector" switch or by depressing the "steady" current push button for convenience in reading the current value.

All test sets are provided with plug connectors for connecting to the power source and for connecting the output to the track circuit or track loop. The plugs and receptacles are designed to prevent the possibility of improper connections.

Normally, the various code speeds are obtained by operating the "code selector" switch which is a part of the instrument. Frequently it is desirable to obtain the various code speeds when the inspector is in the engine cab or at some other point removed from the test set. A remote control switch can be connected to the instrument by means of a cable plug-connected to a receptacle on the panel. The remote control switch has four positions with a weather-proof, rugged housing. Thus the three code speeds in addition to an "off" or no-current condition, can be obtained remotely.

Electronic test sets to provide frequencies from 60 to 140 c.p.s. are available and may have only one frequency or as many as four frequencies in one instrument. In the multiple frequency sets, the different frequencies are selected by means of a "frequency selector" switch.

This is a development of Union Switch & Signal Div., Westinghouse Air Brake Co. A similar device has been developed by the General Railway Signal Co.

Action Recommended

Acceptance as information.

INDUCTOR TEST SET

A portable inductor test set has been developed for testing wayside inductors used in intermittent inductive automatic train stop systems. In such systems, it is essential to the safe operation of trains that the coils of the wayside inductor be connected properly, that they have no short-circuited turns, that there be very high leakage resistance between coil terminals or between the wires connected to these terminals and that the magnetic characteristics of the core are satisfactory. The inductor test set has been designed to provide a reliable and convenient means for periodically testing the inductors.

The inductor test set operates by using a neon tube as an indicator to measure the self-induced voltage created by a single interruption of the current through the inductor under test. By using a capacitor which is part of the instrument, the induced voltage becomes an alternating voltage diminishing rapidly in magnitude. The current used to produce the voltage in the test set is furnished by a small flashlight battery which is a part of the instrument. No external source of power is required for the operation of this test set, thereby rendering it useful at all conceivable locations.

The current is controlled by an "on-off" switch of the spring return toggle type which must be held in the "on" position and automatically returns to the "off" position. The magnitude of this current is indicated by a panel type meter and is controlled by the "current adjustment" knob.

The actual indication of the condition of the inductor under test is detected by observing whether or not the neon tube flashes under the various conditions. A special viewing shield is a part of the instrument and improves the visibility of the neon tube even in the brightest sunlight.

There is a "calibrate-test" switch which is used to check the integrity and adjustment of the test set when in the "calibrate" position and is used in the "test" position when the actual wayside inductor is being tested. The "range" switch selects the circuits so that the polarity of the inductor coils may be checked, and also selects the range of the meter when testing for the number of short-circuited turns. The scales are for 0, 5, 10, 15 and 30 short-circuited turns. These same scales are used when determining the leakage resistance across the coil terminals, through the use of a calibration table. Values up to 50,000 ohms may be detected by this instrument.

The leads for connecting the instrument to the inductor circuit are plug connected and are included as part of the test set. This instrument is $6 \times 6\frac{1}{4} \times 9$ inches and weighs, complete with battery, 12 pounds. The test set has a removable hinged cover with carrying handle, and complete operating instructions.

This is a development of the Union Switch & Signal Div., Westinghouse Air Brake Co.

Action Recommended.

Acceptance as information.

COOPERATIVE REPORT

COMMUNICATIONS SECTION, A.A.R.
COMMITTEE 4—RADIO AND ALLIED COMMUNICATIONS

J. I. Kirsch, Representative

Committee 4—Radio and Allied Communications of the Communications Section, A.A.R., have reported on the following items containing information which should be of importance to the Signal Section:

Docket No. 3—Continue to investigate and report upon the technical feasibility and practicability of using ultra-high frequency or microwave for railroad communications, and, if found desirable, prepare requirement specification.

The Committee is of the opinion that it is very desirable to prepare a requirement specification for microwave equipment, as far as the railroads are concerned. Such a specification should, in general, provide transmission standards equivalent to the Type C carrier telephone system, since, if such a specification is not forthcoming, each manufacturer will bring out a different type with resultant difficulties in tying in to present equipment. The requirements will be progressed as soon as sufficient information on the needs of the railroads is obtained.

Although the proposed specification might refer directly to communications, any specification prepared should result in establishing practices that would be applicable to the use of such facilities for signaling purposes.

Docket No. 6—Keep in touch with developments and issue specifications as may be needed covering test equipment for radio and inductive carrier.

It is possible that specifications and test equipment developed for radio and inductive carrier purposes may be applicable to certain carrier installations in service or proposed where signaling is involved. This docket as progressed will be scrutinized for any developments beneficial to signal facilities.

Docket No. 10—Investigate and report relative to a small portable carrier type battery operated telephone set having a range of from two to three miles and which will operate over the rails or one rail and the ground for use of railroad maintenance forces.

The following report was submitted by Committee 4 as information to the Communications Section:

The Railway Communications, Inc. has a Model SCC-100 two-way carrier telephone that is battery operated, weighs 15 pounds with batteries (dry). The unit is primarily designed to be clipped to open wire lines and it is claimed that with even poor wire line, a communication circuit of over 100 miles can be accomplished. The set operates on frequencies from 37 to

43 kc. Four low-drain battery type tubes are used, only two of which are in use at any one time. Double side band AM type carrier is employed. A crystal bridge rectifier circuit is used for modulation of the carrier frequency and also for demodulation in the receiver side. The output of the transmitter is plus 10 dbm at an impedance level of 600 ohms. The set is constructed to use either a handset or speaker which is contained in the unit. The physical size of the unit is $9\frac{1}{4}$ inches high, $10\frac{7}{16}$ inches wide and $5\frac{1}{2}$ inches deep. No information was supplied regarding squelch circuits, but because of the extreme lack of tubes, it is assumed that no squelch action is employed. The company claims long battery life, but no definite life expectancy was communicated. Also, the probability of its operating for any distances when connected between one rail and ground was not explored.

Docket No. 106—Investigate and report on practicability of vacuum tube aging devices to simulate conditions in mobile service with a view to reducing tube failure in service. If found desirable prepare specification for such a device.

The following report was submitted by Committee 4 as information to the Communications Section:

Investigation of activities of vacuum tube manufacturers and users regarding the use of aging devices reveals that manufacturers have been using shock table testing in connection with their studies of mechanical and electrical deficiencies in various tube types. One air line in Canada has been using a shock table to enable them to study differences between makes and types of tubes using sample lots of each.

No evidence has come to light where any vacuum tube user has used shock and/or vibration equipment for the purpose of aging tubes. In fact, all use of vibration testing equipment has been on a destructive test basis only. The Trans-Canada Air Lines, the only tube user to make use of the vibration tests, tested tubes to failure in comparing sample lots of various makes and types.

Manufacturers contacted regarding the advisability of tube aging devices take a dim view as to any beneficial results being accomplished. Their stand is that any action toward improvement in vacuum tube reliability should be processed through the manufacturer similar to the program set up with them by ARINC.

It would appear that the first step in determining the necessity for use of any type of tube aging device would be in ascertaining the seriousness of early tube failures as compared to probable benefits that would be derived by aging prior to placement in service. In 1948 the airlines of the United States (the nearest comparable service to railroad radio) computed that the first high period of tube failures occurred at about the 125th hour of use, after which time failures dropped materially until sufficient hours were accumulated for loss of emission to become the predominant cause for failure. Since that time, however, the manufacturers have done considerable work in studies to determine weaknesses in tubes and have re-designed many of their types to improve the reliability and life expectancy of them. This is particularly true in the case of the ruggedized version of certain

predominantly used tubes. It is therefore to be expected that the percentage of early tube failures today as compared to a few years ago would be materially less. One railroad kept track of early tube failures and developed that 2 per cent of tube replacements in mobile equipment failed the first month. Another railroad reported that by applying filament voltage alone for 170 hours before placing tubes in service, 1 per cent of the tubes so aged were rejected. It is appreciated that no bias or plate voltage nor vibration was applied. It was found that 1.2 per cent of the so aged tubes failed within the first month of service, which closely correlates with findings of the former railroad of 2 per cent early tube failures.

Action Recommended

Acceptance as information.

COMMITTEE XII—CIRCUIT DESIGN

Personnel

H. A. Scott, Chairman

T. L. Carlson, Vice-Chairman

S. R. Bernard	W. Huminik
R. A. Bishop	H. L. Kruke
B. E. Brooksby	E. Pitt
W. H. Claus	L. B. Sinclair
B. R. Dellinger	D. H. Steiner
O. C. French	C. L. Steinmetz
A. N. Goodson	R. E. Testerman
H. A. Haines	M. R. Williams
H. L. Hinton	F. Youngwerth
E. W. Horning	A. Hoogerhyde*

G. O. Ferm*

Signal Section, A.A.R.:

The following outline of work has been assigned:

1. Indexing signal literature.
2. Prepare typical circuits representing current practice for railway signaling, as follows:
 - (a) Automatic block signals.
 1. For track equipped for operation in one direction only.
 - (a) Color light type signals, conventional d.c. track circuits.
 - (b) Searchlight type signals, conventional d.c. track circuits.
 - (c) Coded track circuits with and without use of line wires.
 - (d) Electric switch locking.
 - (e) Spring switch protection.
 - (f) Approach and advance lighting.
 - (g) Light out protection.
 2. For track equipped for operation in both directions.
 - (a) Color light type signals, conventional d.c. track circuits.
 - (b) Searchlight type signals, conventional d.c. track circuits.
 - (c) Coded track circuits.
 - (d) Electric switch locking.
 - (e) Spring switch protection.
 - (f) Approach and advance lighting.
 - (g) Light out protection.
 - (b) Interlocking.
 1. Relay type interlocking, unit and route types.
 - (a) Route-check network (lever-agreement relays).
 - (b) Signal control network.
 1. Color light type signals.
 2. Searchlight type signals.
 - (c) Signal indication.

* Consulting Member.

(b) Interlocking.—Continued.

- (d) Time locking.
- (e) Approach locking.
- (f) Route locking.
- (g) Switch locking.
- (h) Switch control.
- (i) Switch indication.
- (j) Power distribution.
- (k) Model board indications.
- (l) Remote control circuits.
- (m) Electric locking of hand-operated switches within interlocking limits.
- (n) Traffic locking.
- (o) Movable bridge protection.

2. Automatic interlocking.

(c) Highway crossing signal protection.

- 1. Control arrangement.
 - (a) Selective speed controls.
- 2. Types of protection.
 - (a) Flashing lights.
 - (b) Automatic and semi-automatic gates.

(d) Wayside typical circuits for train stop, train control, and cab signals.

- 1. Continuous.
- 2. Intermittent.

(e) Classification yard signal systems.

- 1. Hump, repeater, trimmer and switch signal circuits.
 - (a) Color light.
 - (b) Searchlight.
- 2. Switch control circuits.
 - (a) Electro-pneumatic.
 - (b) Electric.
- 3. Retarder circuits.
 - (a) Electro-pneumatic.
 - (b) Electric.
- 4. Special circuits.

(f) Miscellaneous.

- 1. Power and color light train order signals.
- 2. Lightning protection.
- 3. OSing devices.
- 4. Control and indication circuits using electronic devices.

3. Prepare compilation of principles of basic current design.

The Committee submits for consideration, reports on the following subjects*:

- 2. A.A.R. Sig. Sec. 8053B, 8059A, 8061A, 8071A, 8072A, 8073A, 8074A, 8075A and 8076A.

* Suggestions or criticisms should be submitted in writing to the Chairman of the Committee on or before August 28, 1953.

TYPICAL CIRCUITS REPRESENTING CURRENT PRACTICE
FOR RAILWAY SIGNALING*

The Committee presents 20 typical circuit plans and a revision of one plan originally submitted at the 1950 Annual Meeting.

These plans represent current practice on one or more Member Roads and have been selected as appropriate to meet current signal problems. The plans are not to be considered as working drawings; rather it should be understood that they are typical plans only, and in their application to a specific signal situation full consideration must be given the type of equipment to be employed and the local governing conditions.

The plans presented are:

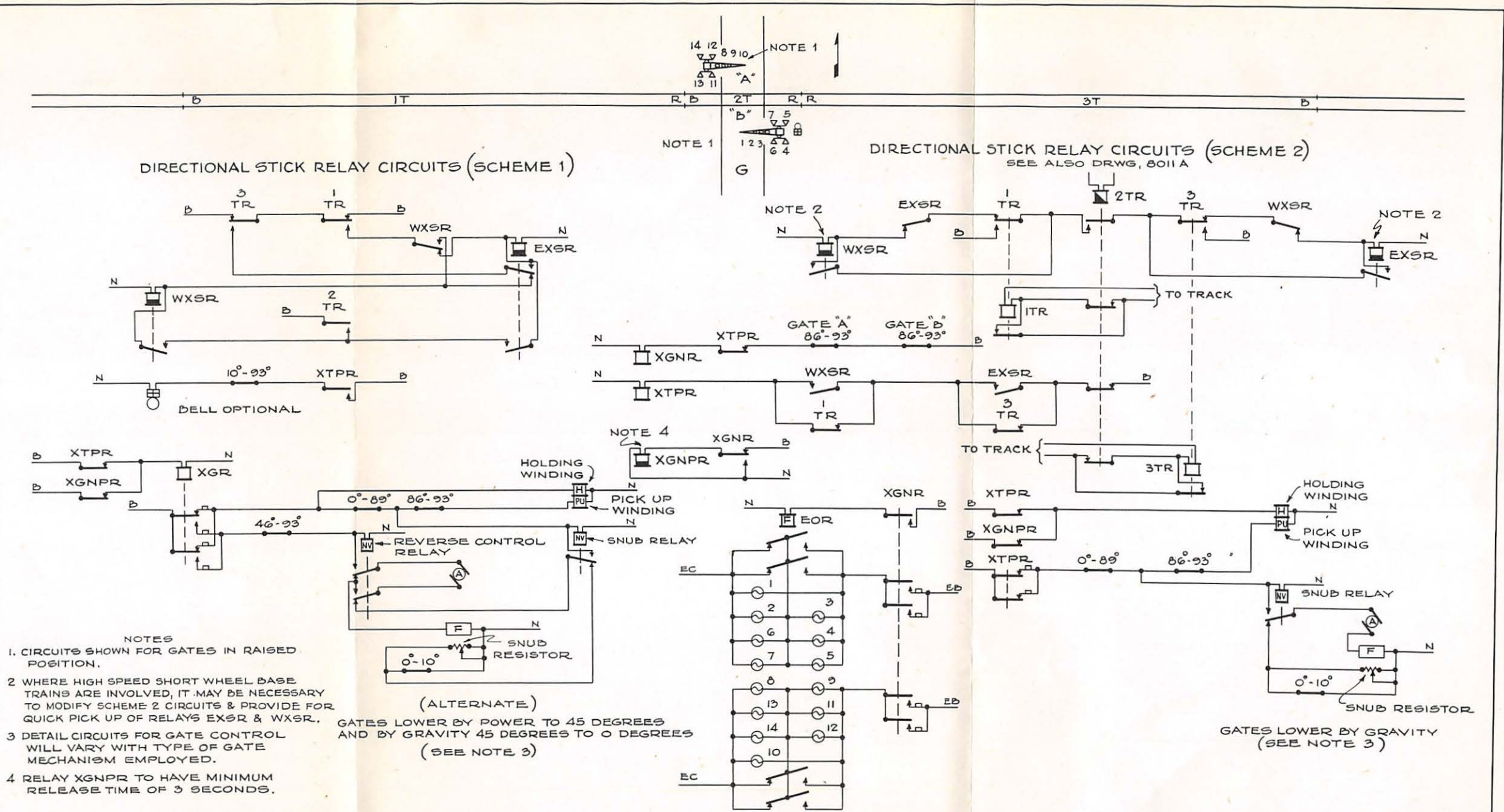
A.A.R.
SIG. SEC.

- 8053B—Circuits for automatic highway crossing gates. (This plan has been revised to include the detail of track stick circuits in Scheme 2.)
- 8059A (Sheets 5 and 6)—Typical normally de-energized coded track circuits and traffic control without line wires at end of siding location. (Assignment 2-a-2-c)
- 8061A—Typical light out protection circuits to prevent display of less restrictive aspects as applied to color light signals of the doublet type. (Assignment 2-a-1-g)
- 8071A (Sheets 1 through 7)—Typical circuits for an all-relay interlocking of the route type. (Assignment 2-b-1)
- 8072A (Sheets 1 through 3)—Typical circuits for control and indication of hump and trimmer signals and switch machines of a classification yard system. (Assignments 2-c-1-a and b)
- 8073A—Typical circuits for control and indication of a remote block signal using coded carrier frequency with indications transmitted by inverse coded carrier frequency. (Assignment 2-f-4)
- 8074A (Sheets 1 through 3)—Typical traffic control circuits using normal steady energy coded track circuits. Sheets 1 and 2 cover signaling at end of siding and Sheet 3 covers an intermediate signal location with signals located opposite each other. (Assignment 2-a-2-c)
- 8075A (Sheets 1 and 2)—Typical circuits for control of wayside inductors of an automatic train stop system intermittent inductive type. (Assignment 2-d-2)
- 8076A—Typical circuits for control of an electric switch lock applied to crossover between main tracks signaled in both directions. (Assignment 2-a-2-d)

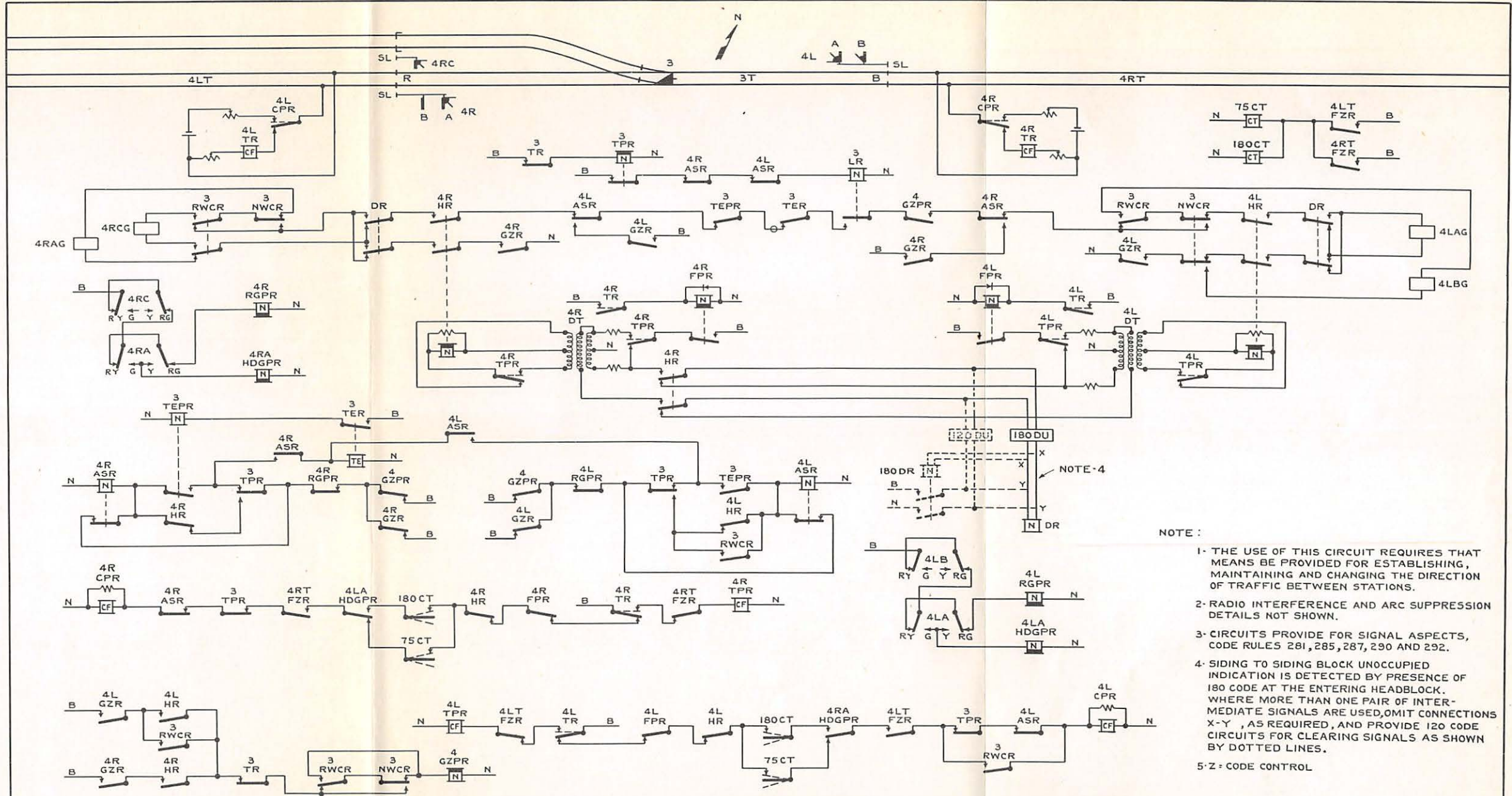
Action Recommended

Acceptance as information.

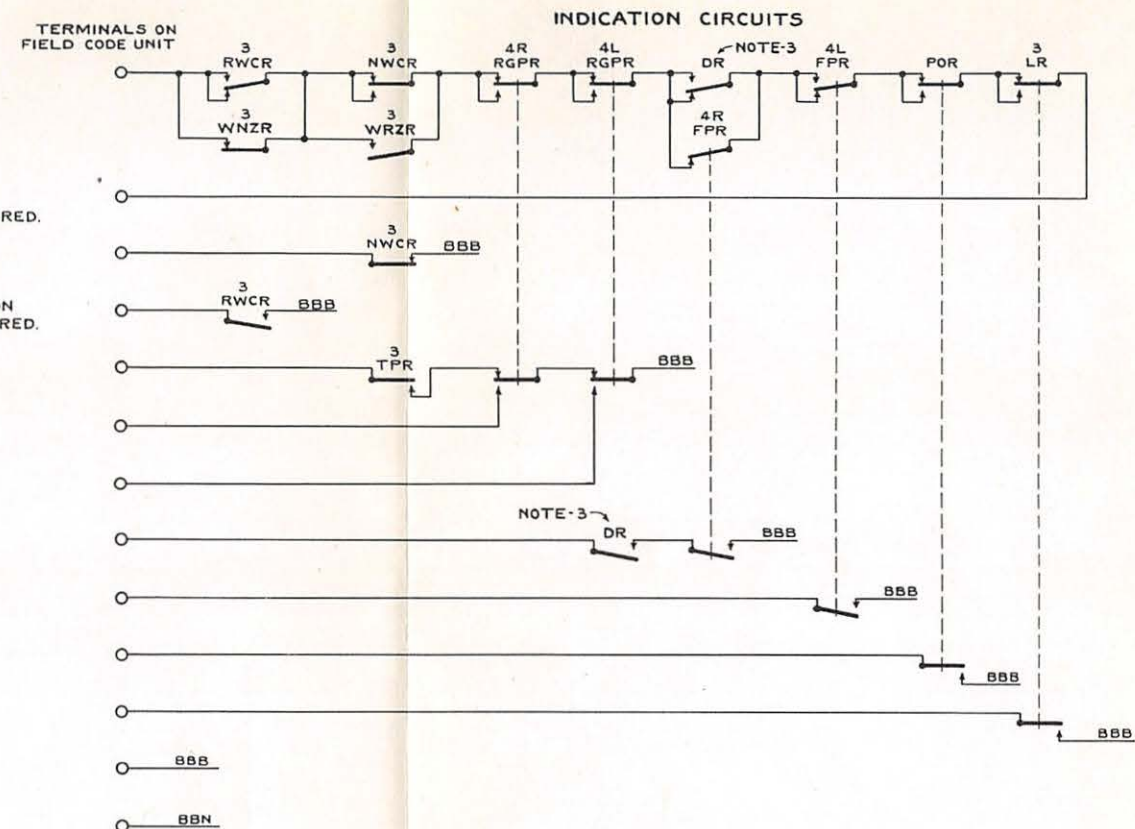
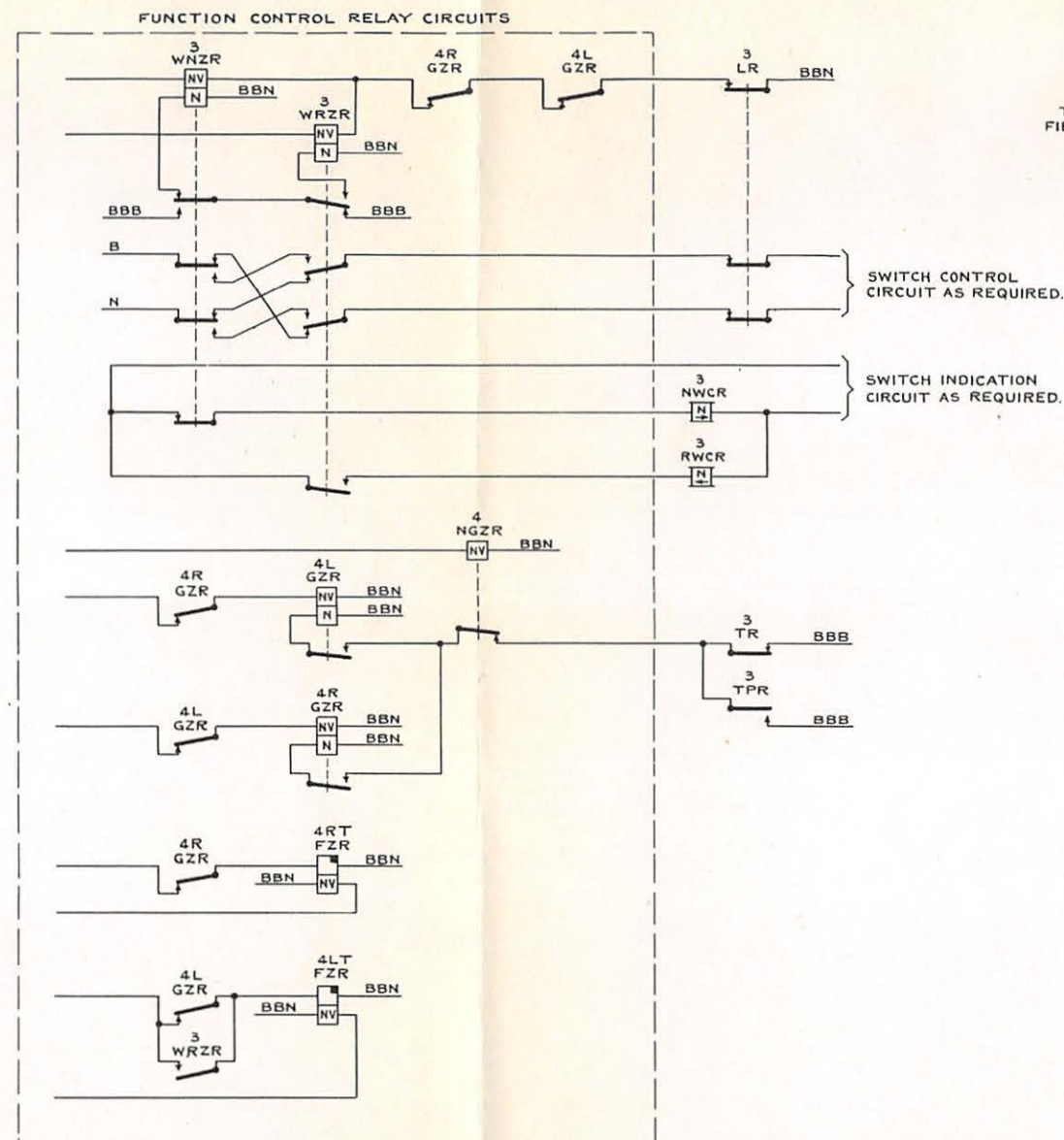
* Previous report on this subject appears in A.A.R. Signal Section 1951 Proceedings, Vol. XLIX, pp. 331 and 357.



TYPICAL CIRCUITS FOR AUTOMATIC HIGHWAY CROSSING GATES



TYPICAL NORMALLY DE-ENERGIZED CODED TRACK CIRCUITS
AND TRAFFIC CONTROL WITHOUT LINE WIRES
(END OF SIDING LOCATION)



- NOTE :
- 1.- THESE CIRCUITS WILL VARY WITH THE TYPE OF CODE SYSTEM EMPLOYED.
 - 2.- Z = CODE CONTROL.
 - 3.- WHERE MORE THAN ONE PAIR OF INTERMEDIATE SIGNALS ARE USED SELECT THROUGH 180 DR INSTEAD OF DR.

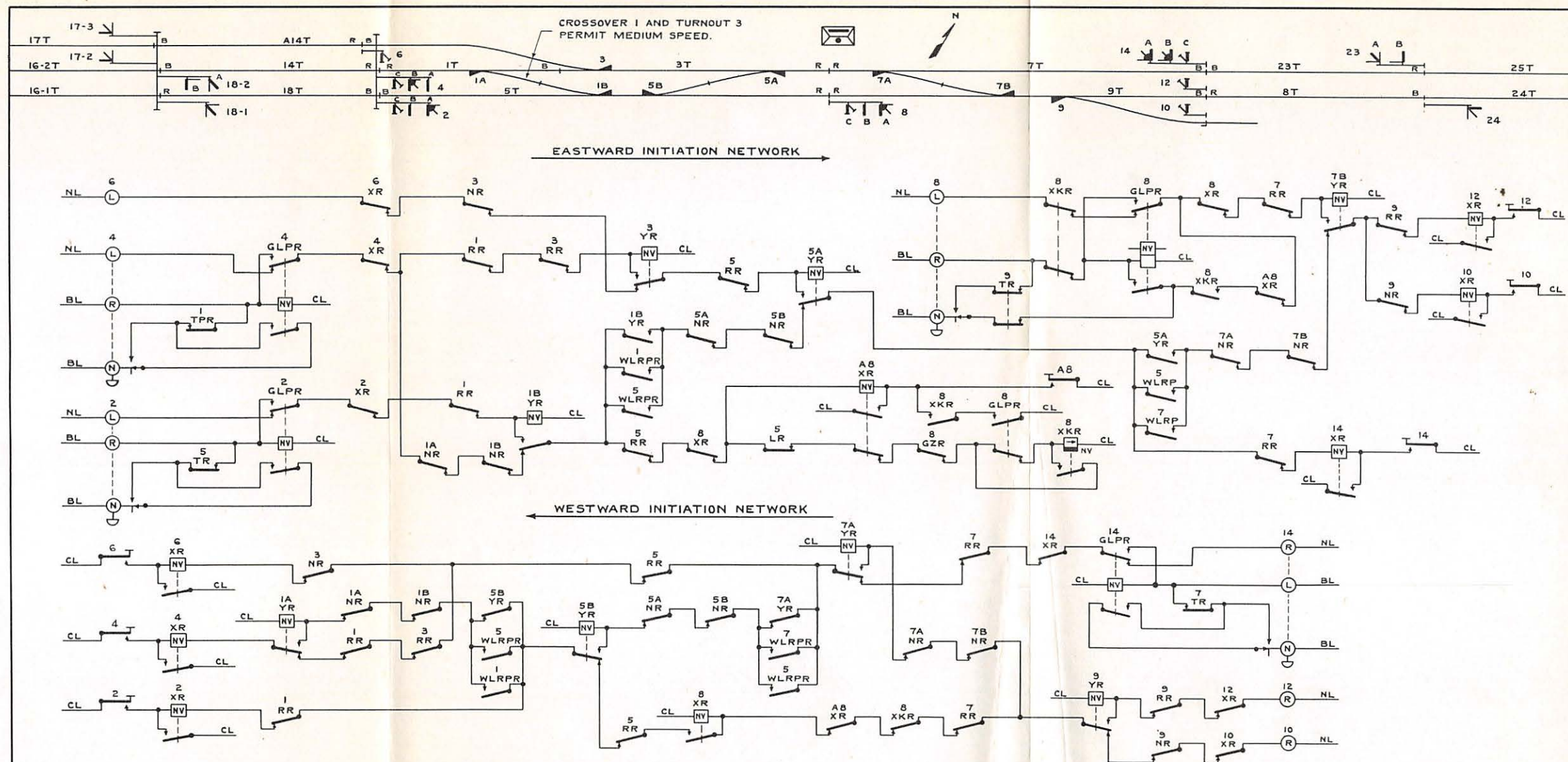
TYPICAL NORMALLY DE-ENERGIZED CODED TRACK CIRCUITS AND TRAFFIC CONTROL WITHOUT LINE WIRES (END OF SIDING LOCATION)

SEPT. 1953

SHEET 6

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NOTE:

- 1- (N) CONTACT MADE ONLY WHEN KNOB IS PUSHED.
- 2- (L) CONTACT BROKEN ONLY WHEN KNOB IS PULLED OR ROTATED.
- 3- (R) CONTACT MADE ONLY WHEN KNOB IS ROTATED LEFT (COUNTERCLOCKWISE).
- 4- (R) CONTACT MADE ONLY WHEN KNOB IS ROTATED RIGHT (CLOCKWISE).

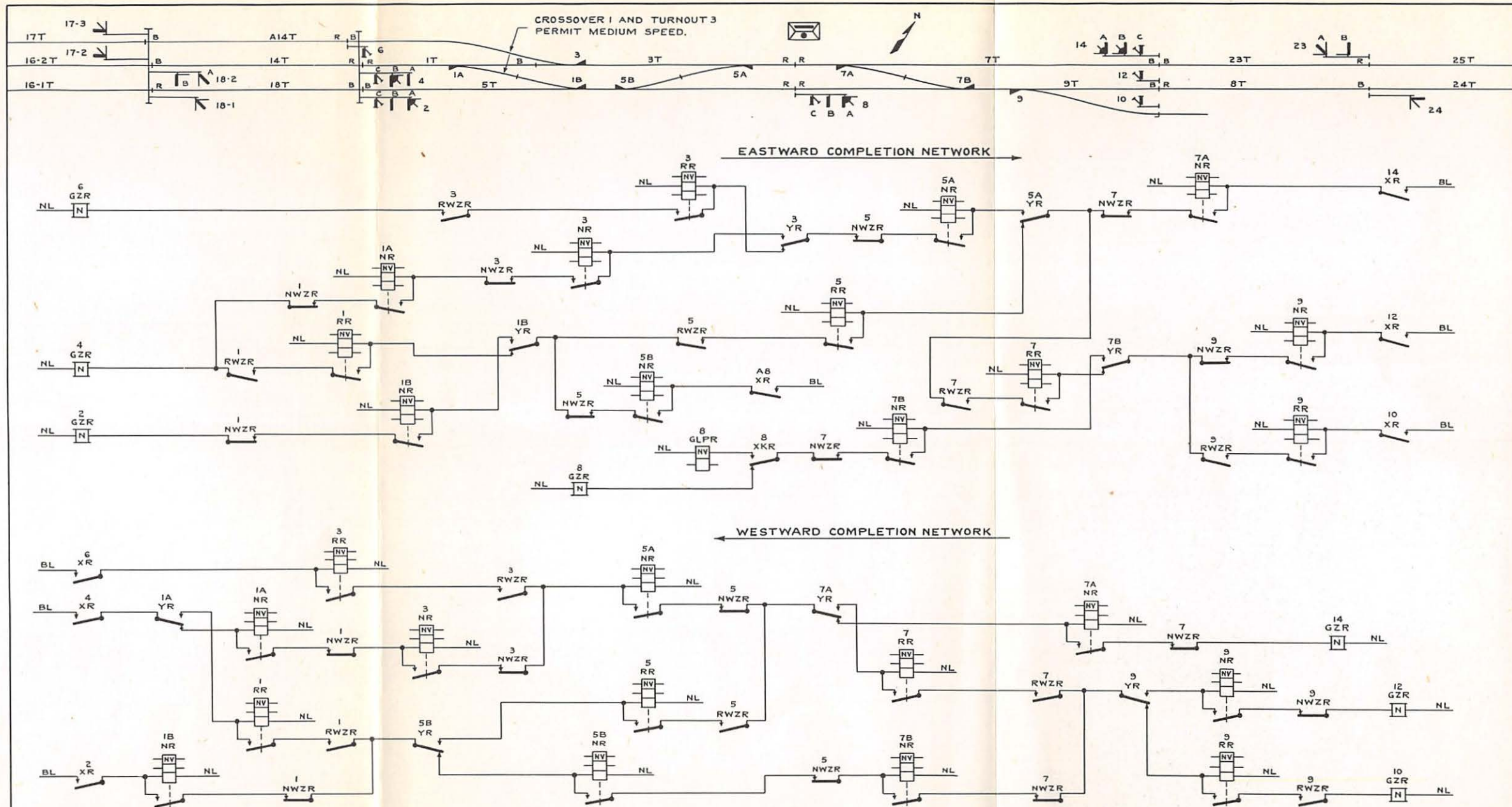
NOTE (CONT.)

- 4- XR = EXIT RELAY
- 5- YR = ROUTE SELECTING RELAY.
- 6- ZR = COMPLETION RELAY.
- 7- UNLESS OTHERWISE INDICATED ALL RELAYS ARE NEUTRAL.

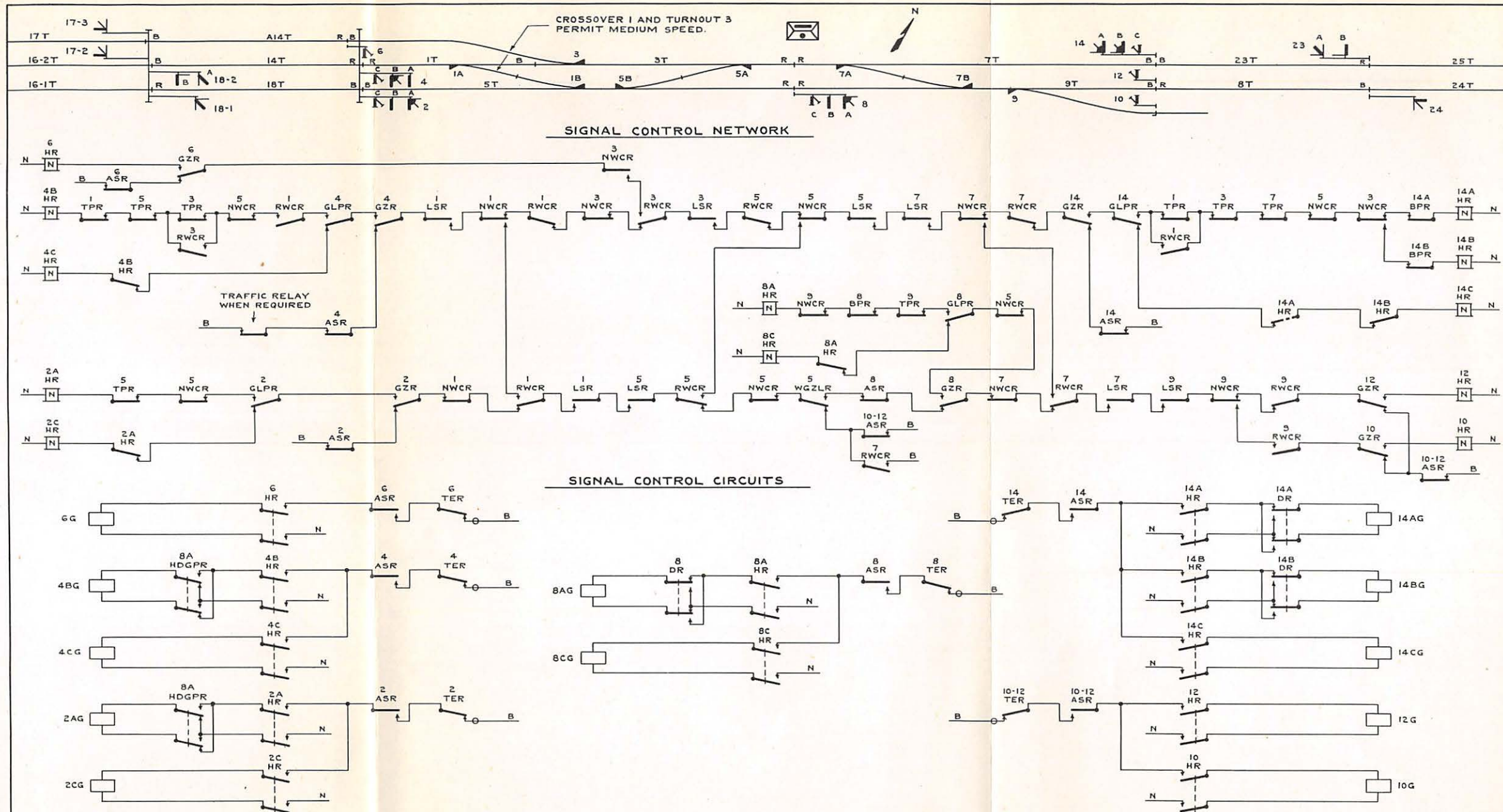
TYPICAL RELAY TYPE INTERLOCKING CIRCUITS LOCAL CONTROL-ROUTE TYPE-SIGNAL LEVERS AND MOVABLE POINT ROUTE INDICATORS IN DIAGRAM

SEPT. 1953

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8071A



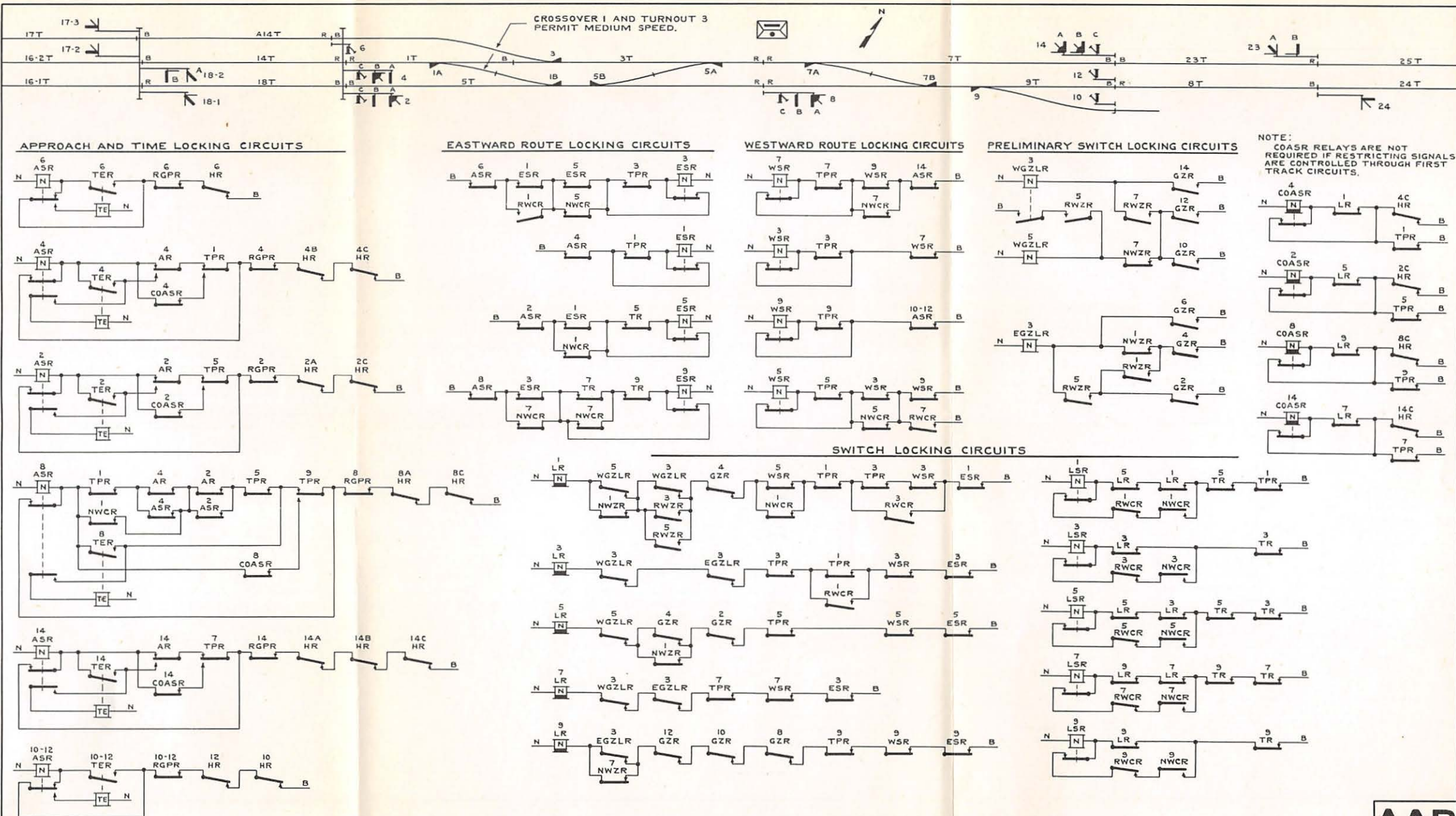
TYPICAL RELAY TYPE INTERLOCKING CIRCUITS
LOCAL CONTROL-ROUTE TYPE-SIGNAL LEVERS AND MOVABLE POINT ROUTE INDICATORS IN DIAGRAM



TYPICAL RELAY TYPE INTERLOCKING CIRCUITS
LOCAL CONTROL - ROUTE TYPE - SIGNAL LEVERS AND MOVABLE POINT ROUTE INDICATORS IN DIAGRAM

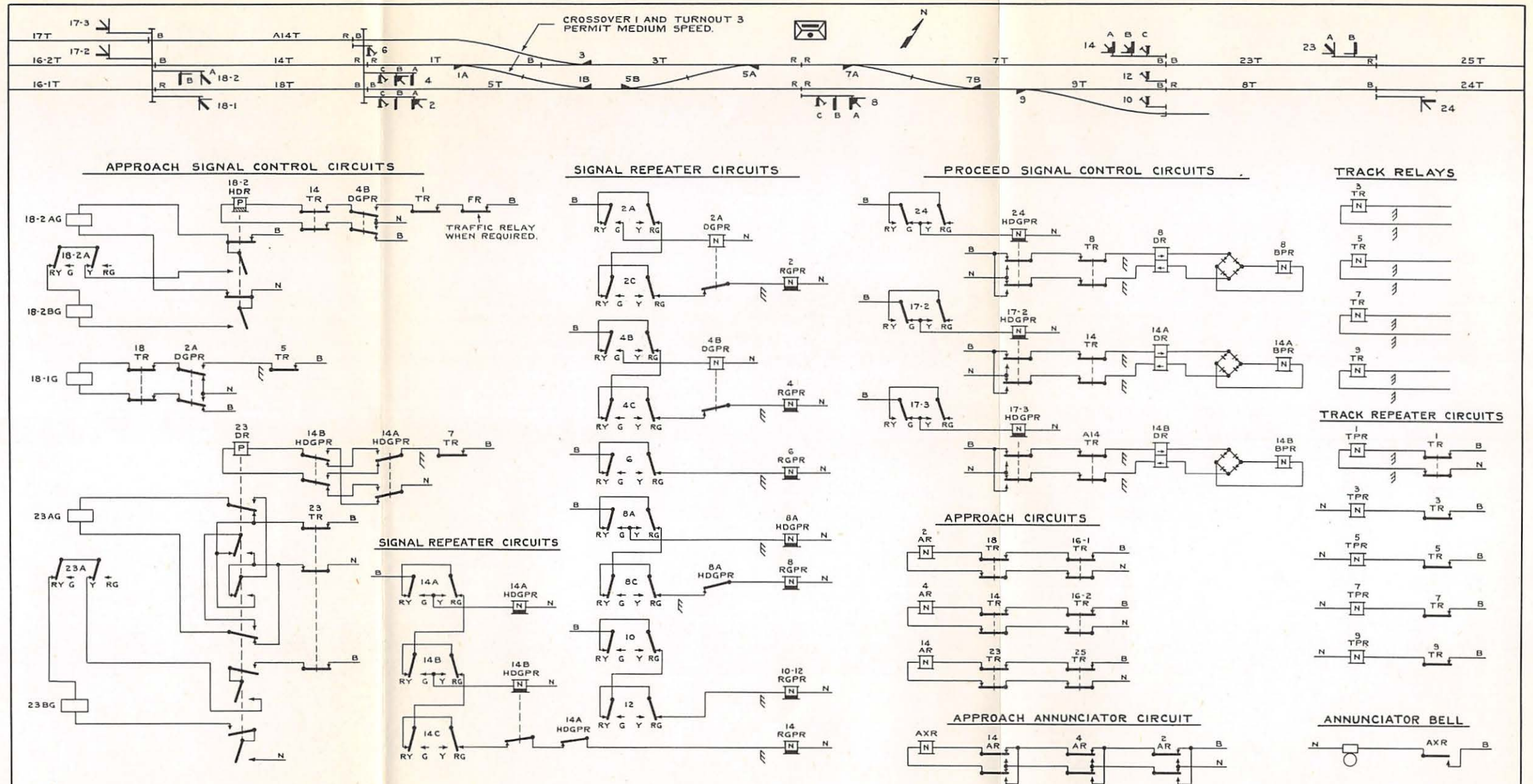
SEPT. 1953

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8071A



TYPICAL RELAY TYPE INTERLOCKING CIRCUITS

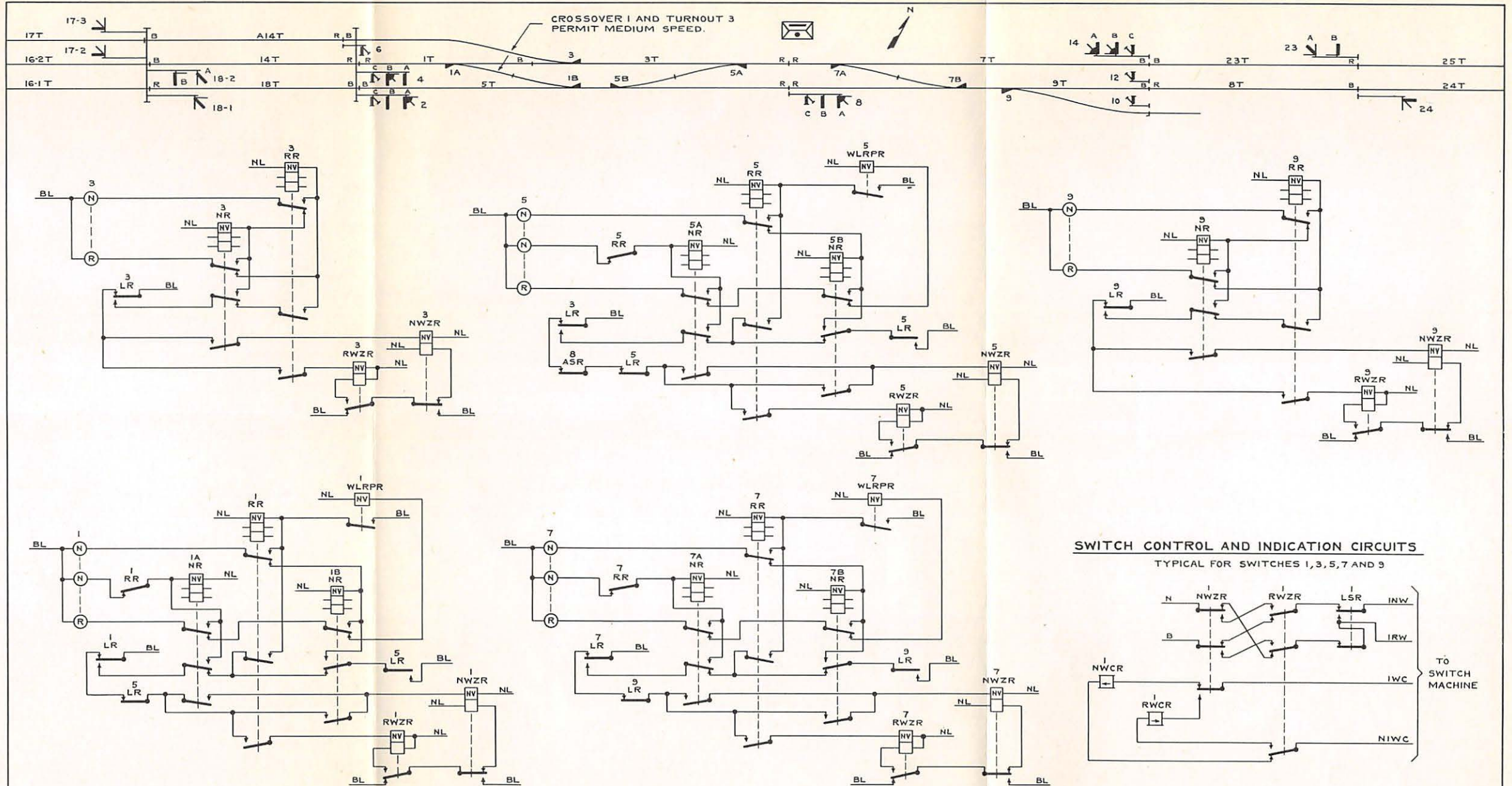
LOCAL CONTROL - ROUTE TYPE-SIGNAL LEVERS AND MOVABLE POINT ROUTE INDICATORS IN DIAGRAM



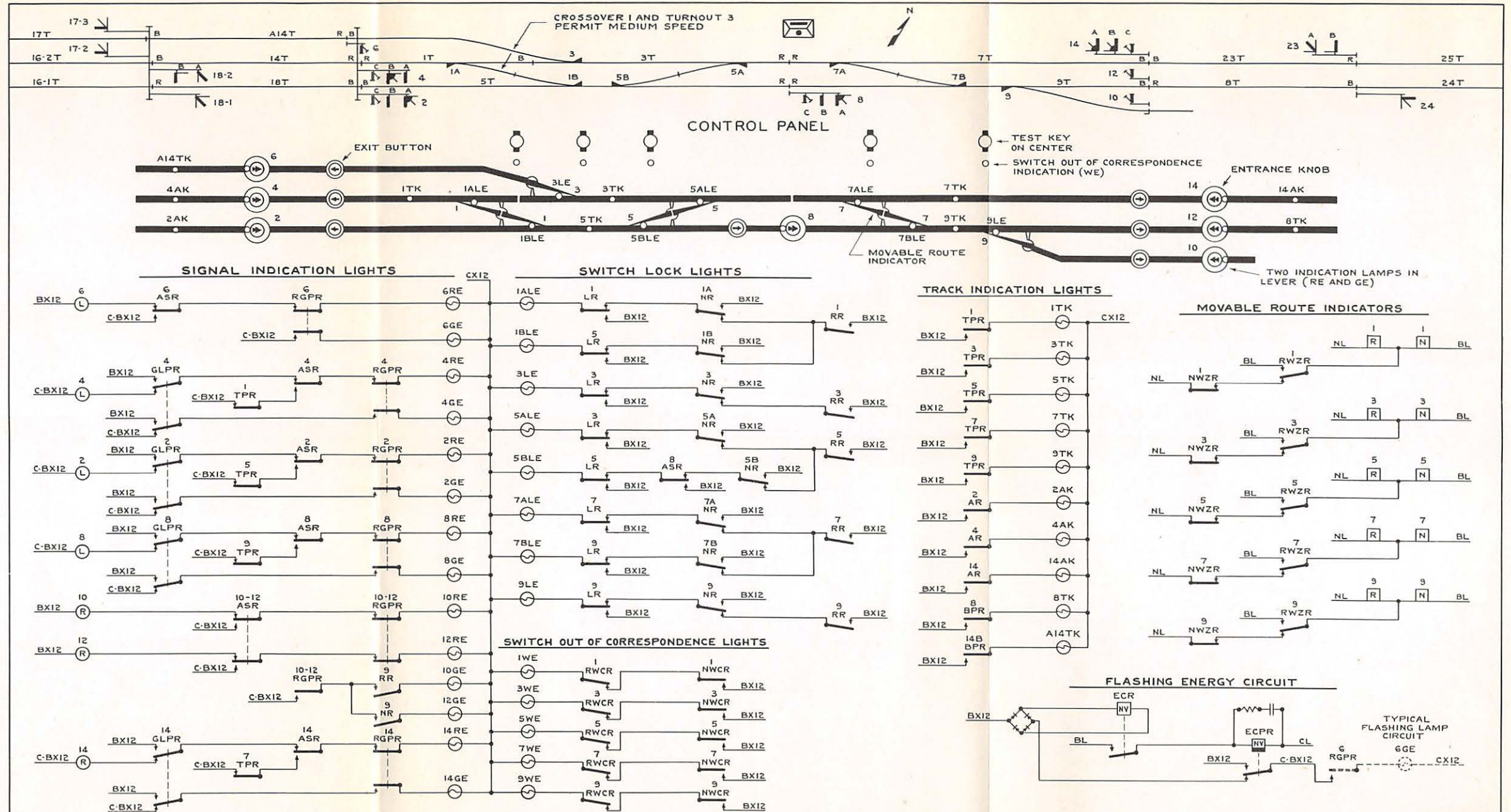
TYPICAL RELAY TYPE INTERLOCKING CIRCUITS
LOCAL CONTROL - ROUTE TYPE - SIGNAL LEVERS AND MOVABLE POINT ROUTE INDICATORS IN DIAGRAM

SEPT. 1953

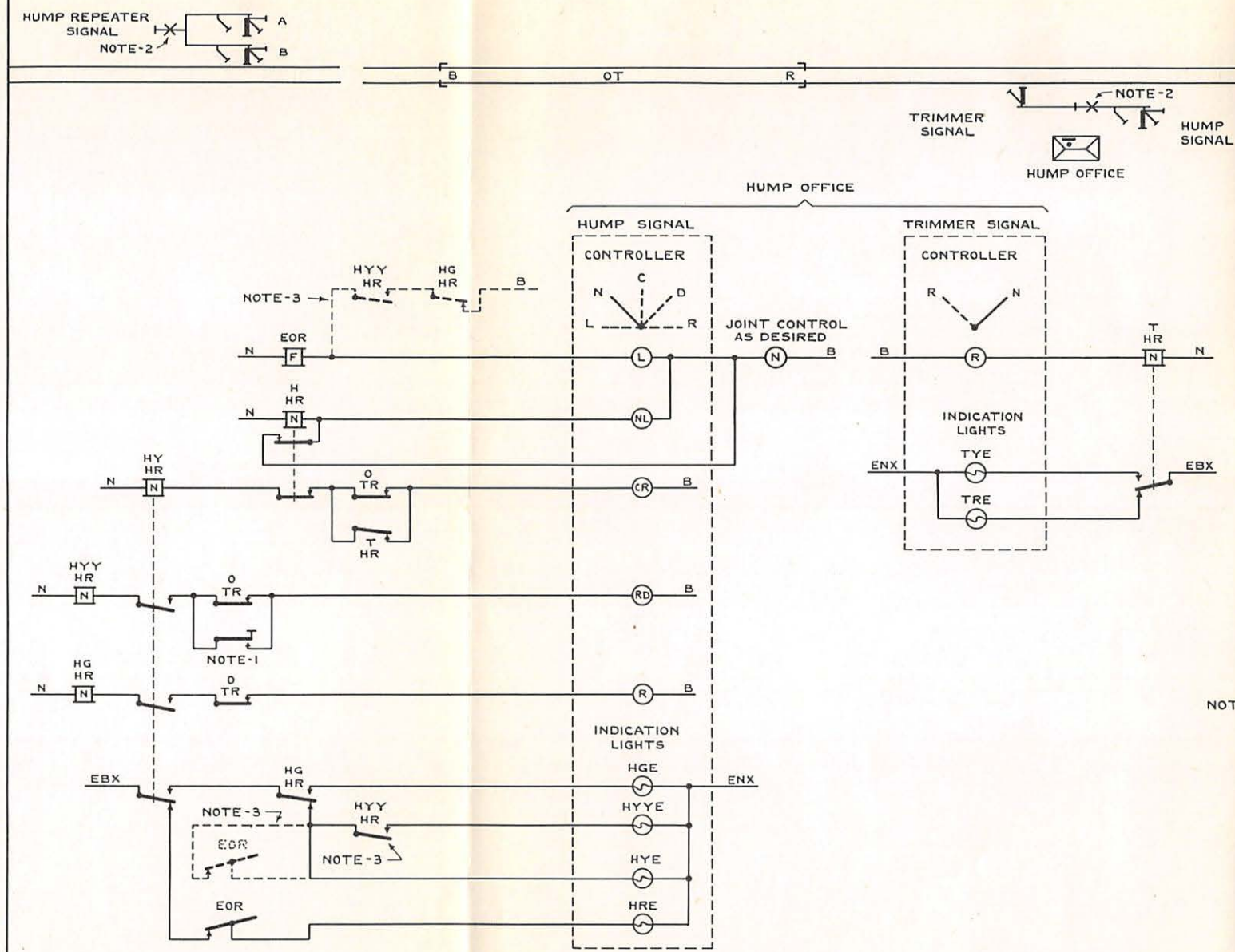
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TYPICAL RELAY TYPE INTERLOCKING CIRCUITS
LOCAL CONTROL-ROUTE TYPE-SIGNAL LEVERS AND MOVABLE POINT ROUTE INDICATORS IN DIAGRAM



TYPICAL RELAY TYPE INTERLOCKING CIRCUITS
LOCAL CONTROL - ROUTE TYPE - SIGNAL LEVERS AND MOVABLE POINT ROUTE INDICATORS IN DIAGRAM



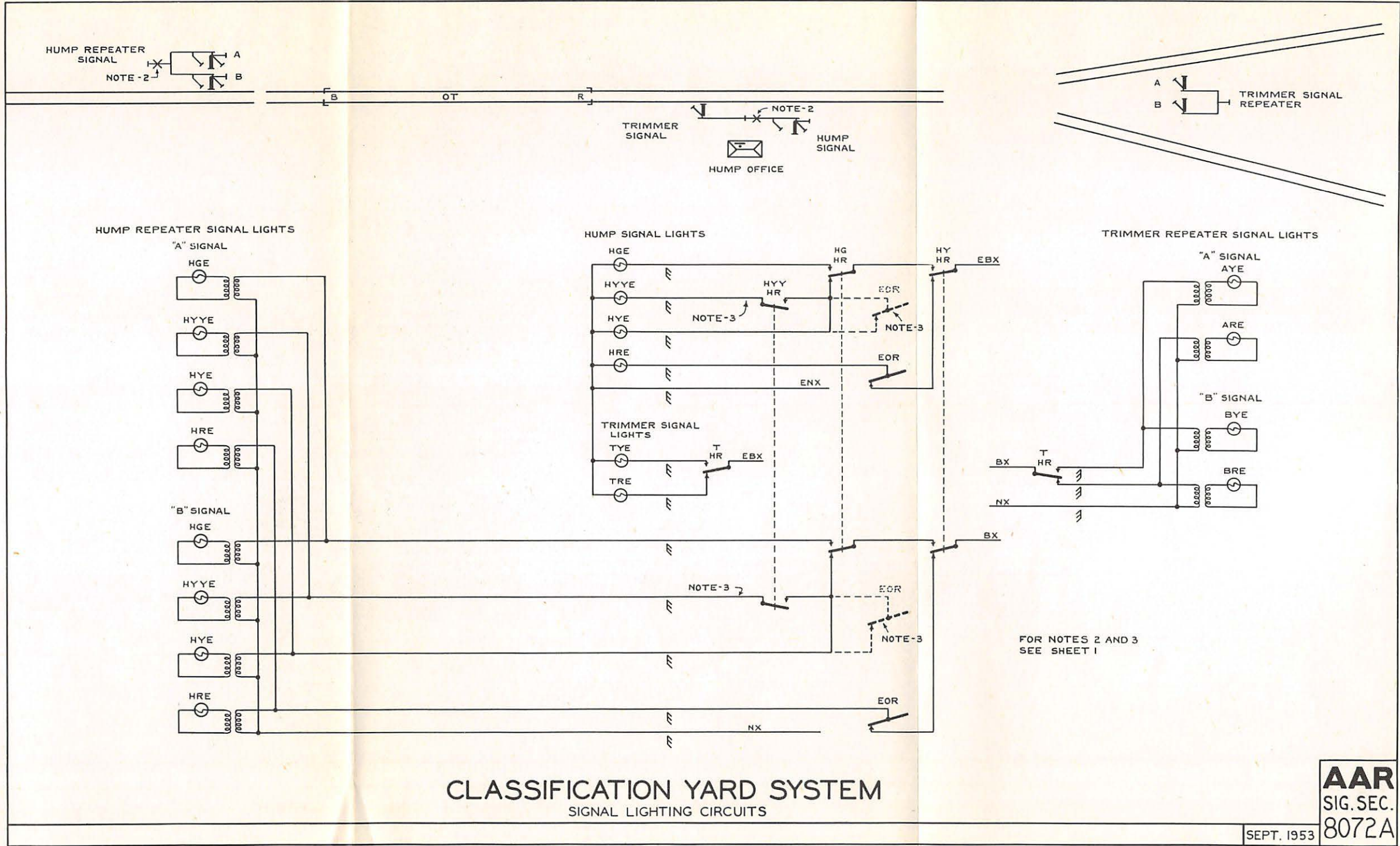
ASPECTS AND INDICATIONS

HUMP SIGNAL		
CONTROLLER POSITION	INDICATIONS	ASPECTS
L	BACK UP	FLASHING R
N	STOP	R
C	PROCEED AT SLOW HUMP SPEED	Y
D	PROCEED AT MEDIUM HUMP SPEED	Y OVER Y OR FLASHING Y
R	PROCEED AT NORMAL HUMP SPEED	G

TRIMMER SIGNAL		
CONTROLLER POSITION	INDICATIONS	ASPECTS
N	STOP	R
R	TRIM	Y

- NOTE :
- 1- TO PROVIDE PROCEED AT MEDIUM HUMP SPEED INDICATION WHEN OT IS OCCUPIED; LOCATE WHERE REQUIRED.
 - 2- DENOTES FLASHING INDICATION, OMIT LOWER UNIT WHEN FLASHING YELLOW INDICATION IS USED.
 - 3- WHEN FLASHING YELLOW IS DESIRED OMIT HYYE CIRCUITS AND ADD CIRCUITS SHOWN DOTTED.

CLASSIFICATION YARD SYSTEM
HUMP AND TRIMMER SIGNAL CONTROL AND INDICATION CIRCUITS



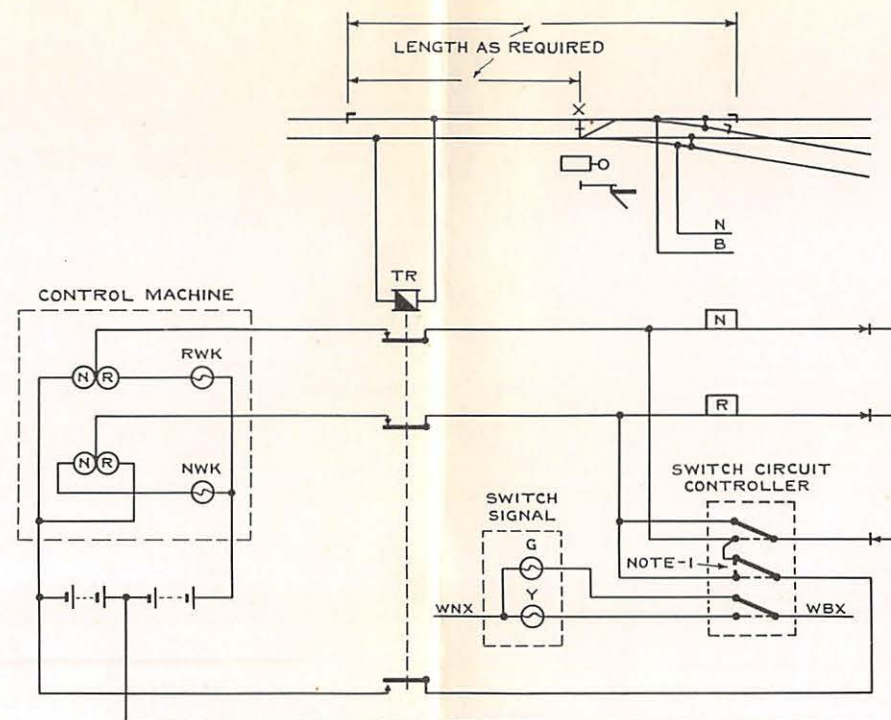


FIG. 1
ELECTRO-PNEUMATIC SWITCH CONTROL

NOTE :
1- TWO POSITION CAM TO MAKE
AND BREAK AT MIDSTROKE.

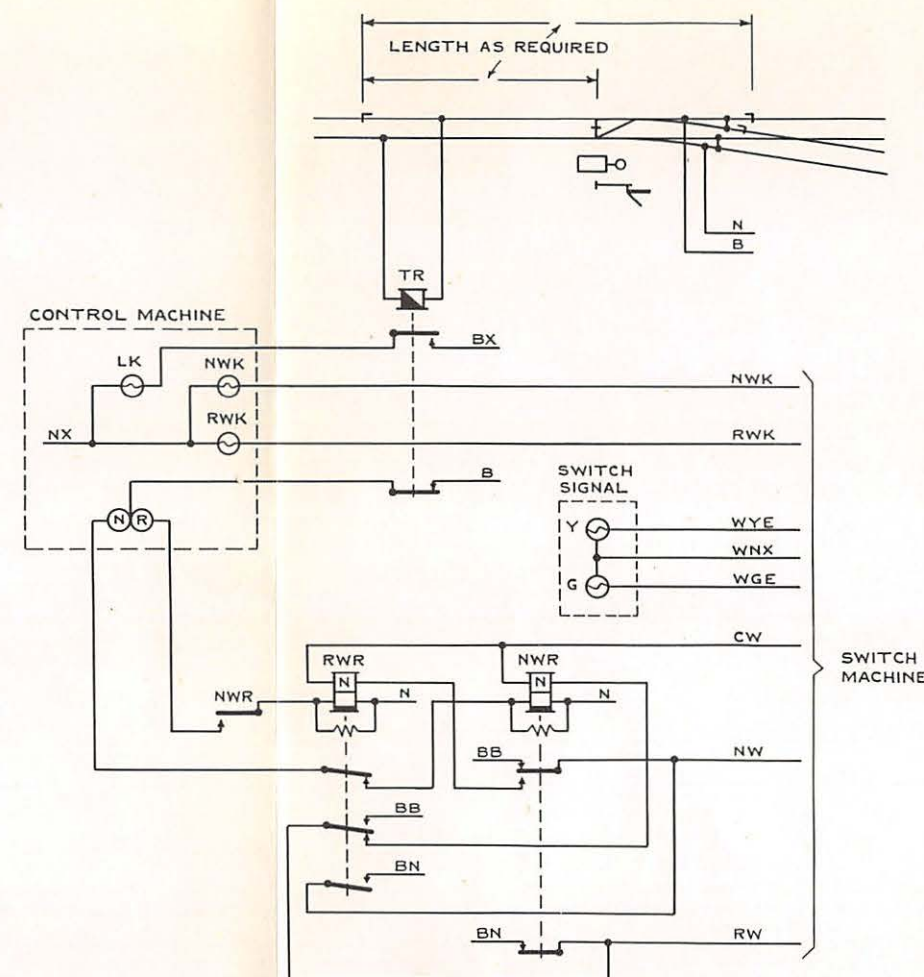
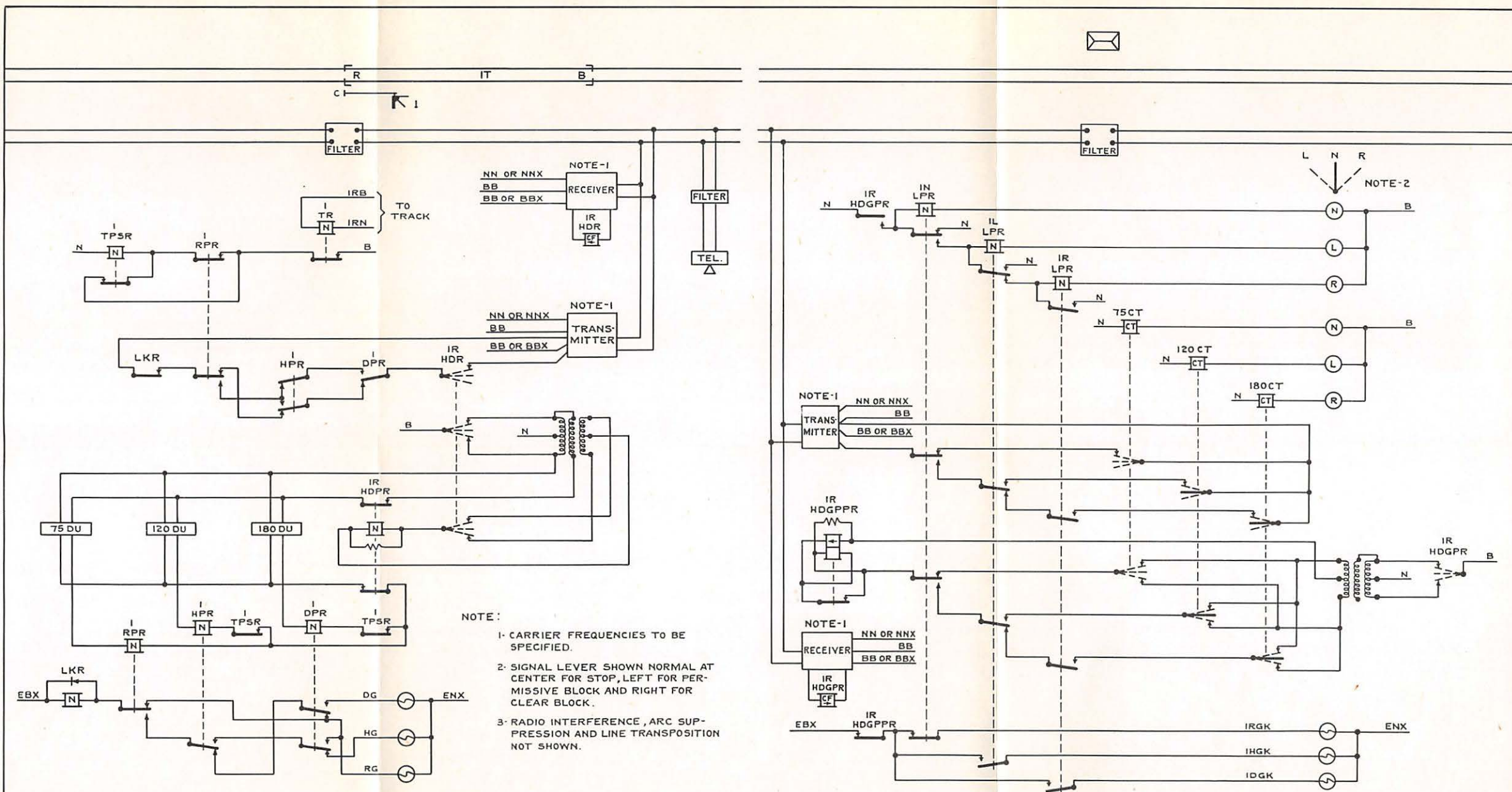
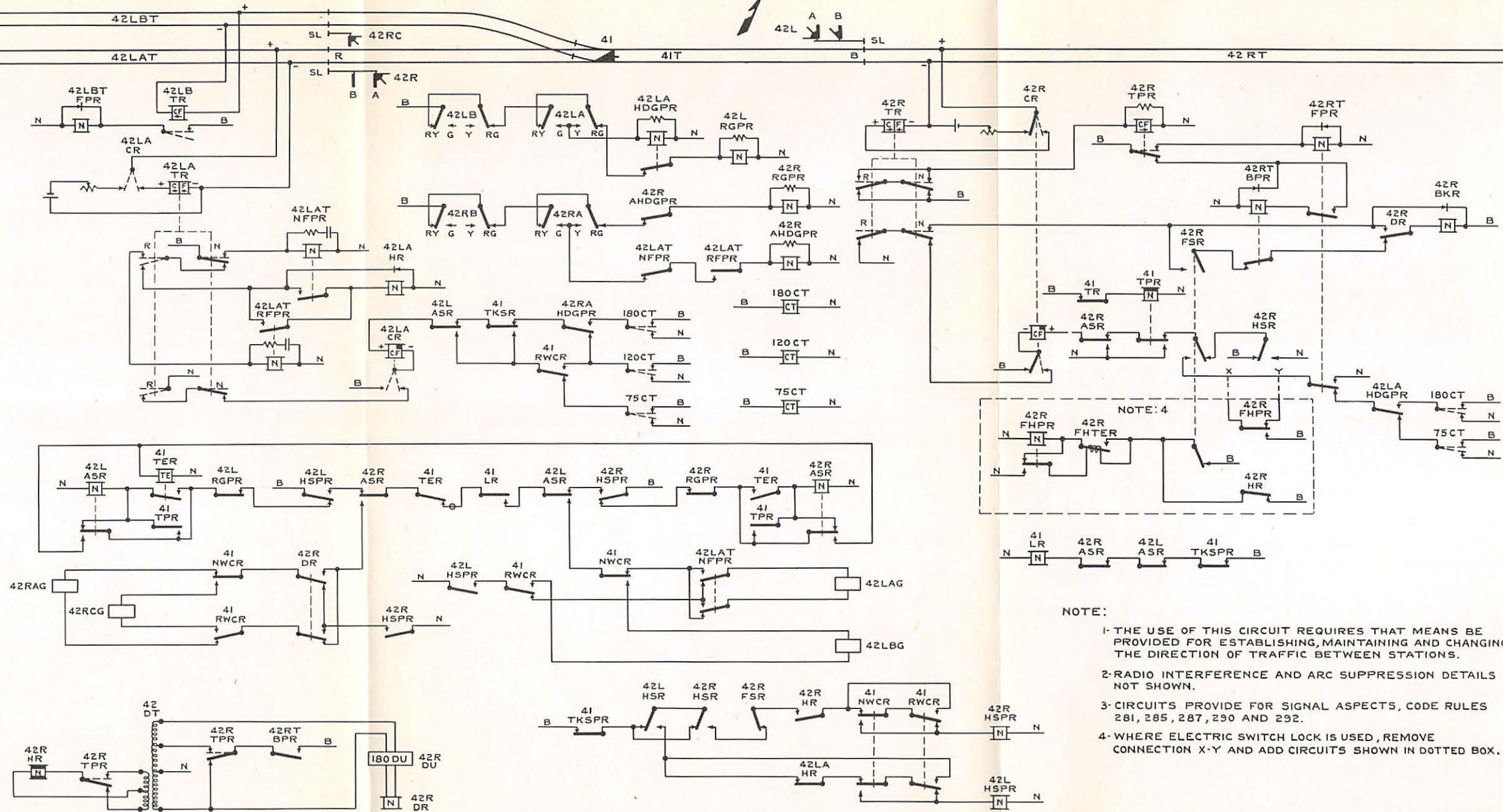


FIG. 2
ELECTRIC SWITCH CONTROL

CLASSIFICATION YARD SYSTEM SWITCH CONTROL AND INDICATION CIRCUITS

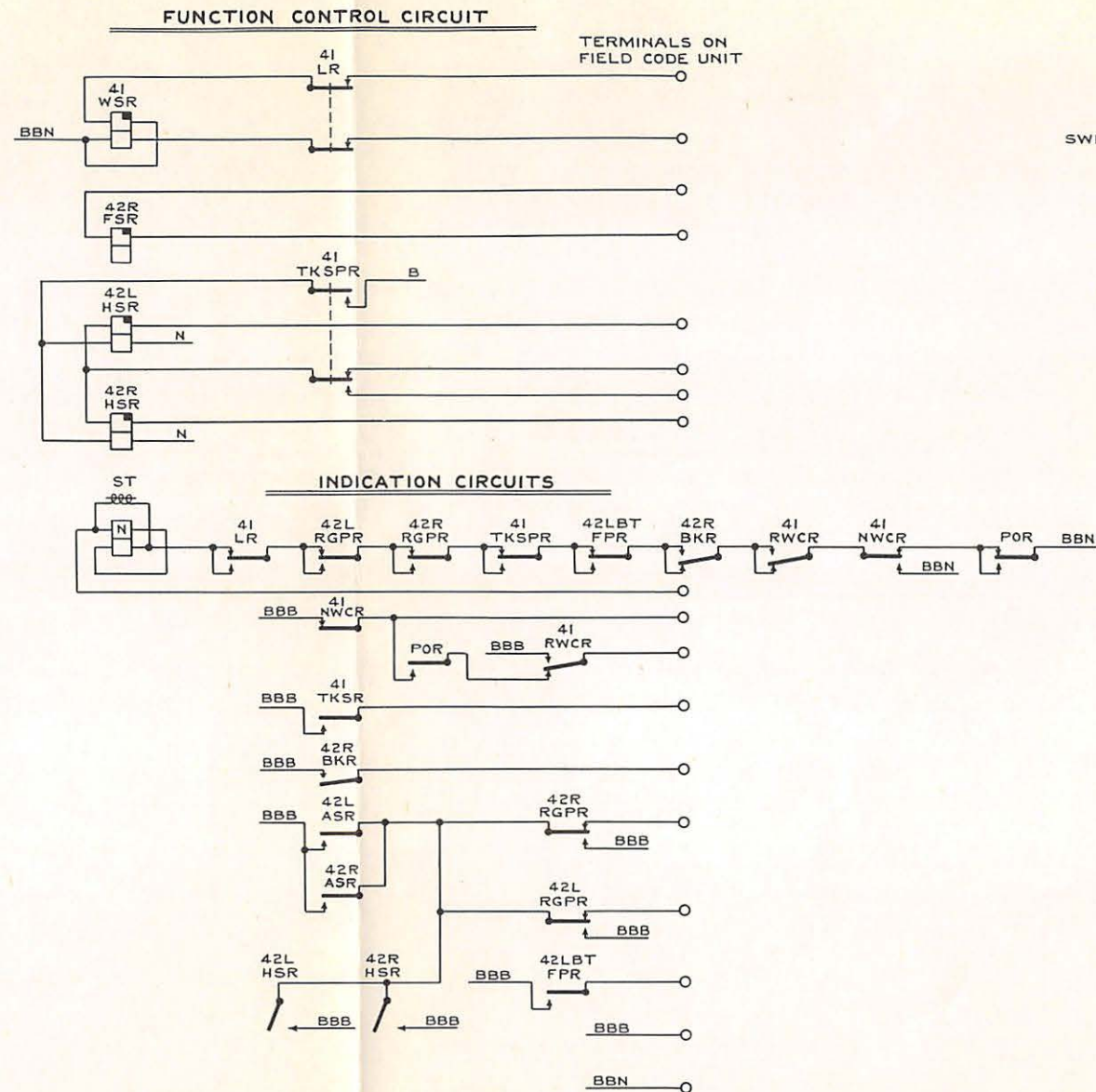


CIRCUITS FOR CONTROL AND INDICATION OF A REMOTE BLOCK SIGNAL, USING CODED CARRIER FREQUENCY
 INDICATIONS TRANSMITTED BY INVERSE (REVERSE) CODED CARRIER FREQUENCY

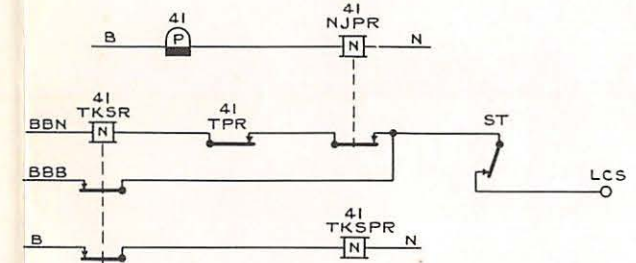
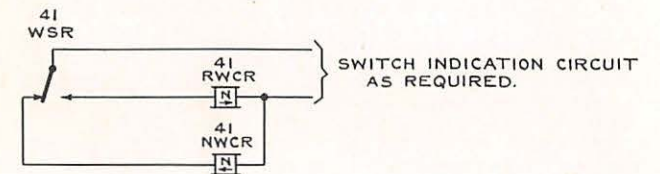
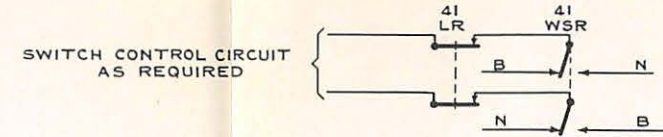


TRAFFIC CONTROL CIRCUITS

USING NORMAL STEADY ENERGY CODED TRACK (END OF SIDING LOCATION)

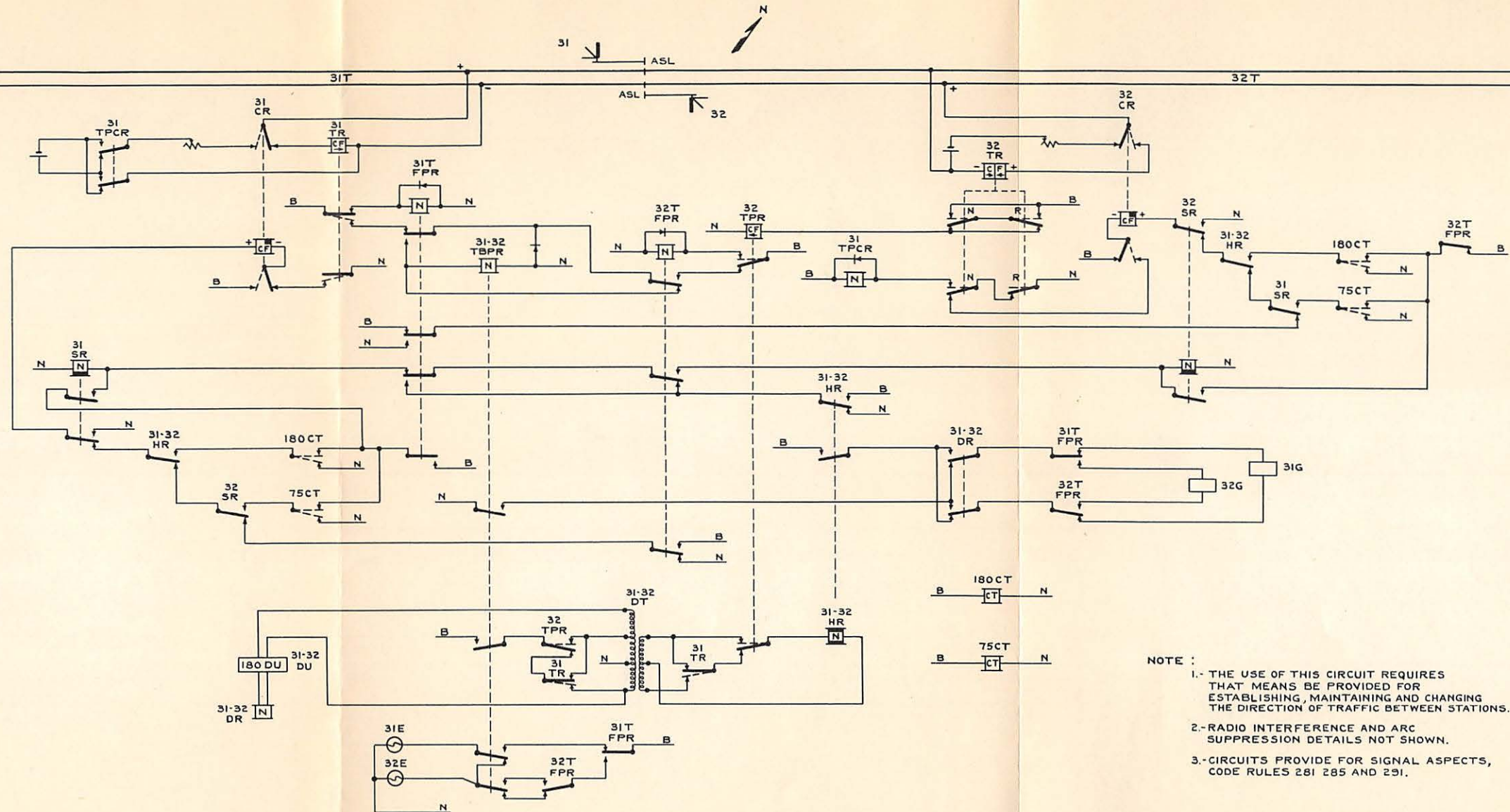


SWITCH CONTROL RELAY CIRCUIT
ELECTRIC MOVEMENT



NOTE :
THESE CIRCUITS WILL VARY WITH THE
TYPE OF CODE SYSTEM EMPLOYED.

TRAFFIC CONTROL CIRCUITS
USING NORMAL STEADY ENERGY CODED TRACK (END OF SIDING LOCATION)



- NOTE :
- 1.- THE USE OF THIS CIRCUIT REQUIRES THAT MEANS BE PROVIDED FOR ESTABLISHING, MAINTAINING AND CHANGING THE DIRECTION OF TRAFFIC BETWEEN STATIONS.
 - 2.- RADIO INTERFERENCE AND ARC SUPPRESSION DETAILS NOT SHOWN.
 - 3.- CIRCUITS PROVIDE FOR SIGNAL ASPECTS, CODE RULES 281 285 AND 291.

TRAFFIC CONTROL CIRCUITS USING NORMAL STEADY ENERGY CODED TRACK (INTERMEDIATE SIGNALS OPPOSITE)

SEPT. 1953

SHEET 3

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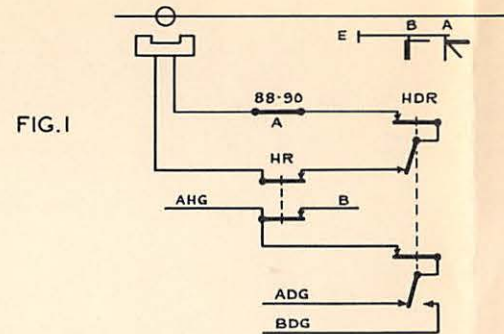


FIG. 1

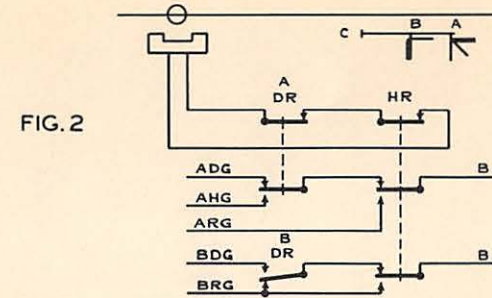


FIG. 2

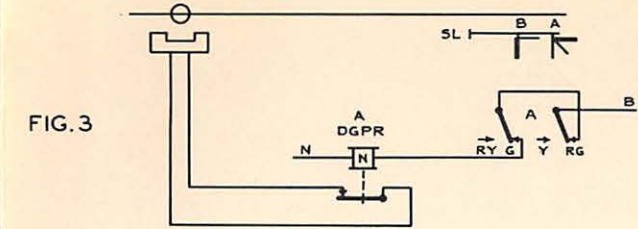


FIG. 3

FIG. 1 FIG. 2 & FIG. 3 = INDUCTOR CIRCUIT FOR CODE RULE 281 FIG. B. SIGNAL ALSO DISPLAYS CODE RULES 282 FIG. B, 285 FIG. B, 291 FIG. A

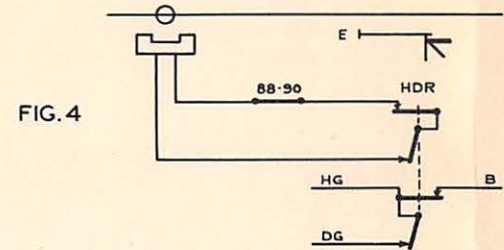


FIG. 4

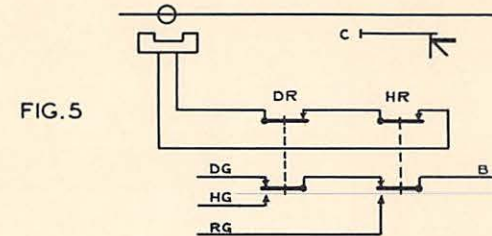


FIG. 5

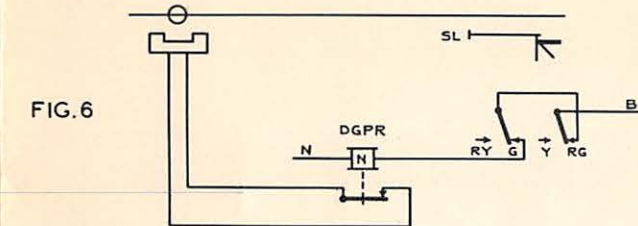


FIG. 6

FIG. 4 FIG. 5 & FIG. 6 = INDUCTOR CIRCUIT FOR CODE RULE 281 FIG. C. SIGNAL ALSO DISPLAYS CODE RULES 285 FIG. C, 291 FIG. B

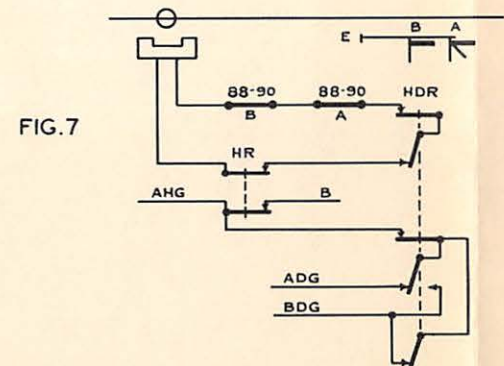


FIG. 7

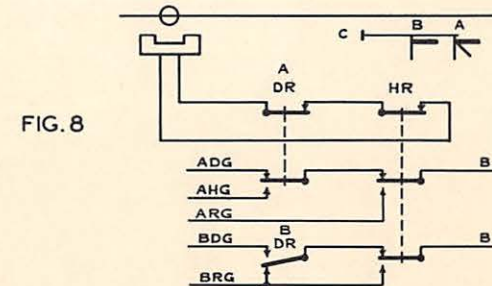


FIG. 8

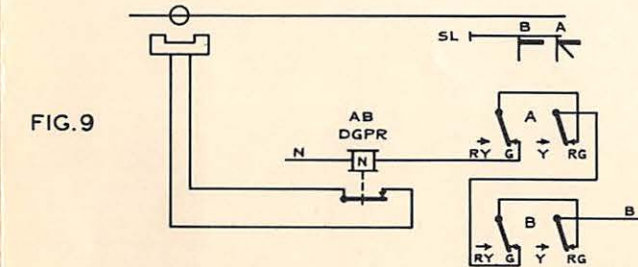


FIG. 9

FIG. 7 FIG. 8 & FIG. 9 = INDUCTOR CIRCUIT FOR CODE RULE 281 FIG. E. SIGNAL ALSO DISPLAYS CODE RULES 282 FIG. B, 285 FIG. B, 291 FIG. A

WAYSIDE TRAIN STOP CIRCUITS

USING INTERMITTENT INDUCTIVE SYSTEM

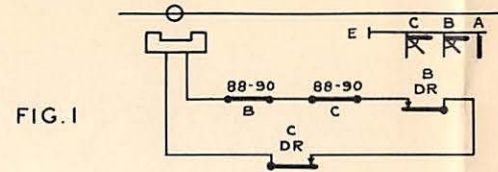


FIG. 1

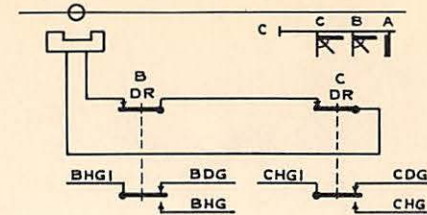


FIG. 2

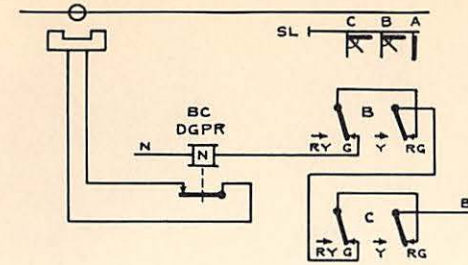


FIG. 3

FIG. 1 FIG. 2 & FIG. 3 = INDUCTOR CIRCUIT FOR CODE RULE 281C. SIGNAL ALSO DISPLAYS CODE RULES 286, 290 FIG. A, 292 FIG. A

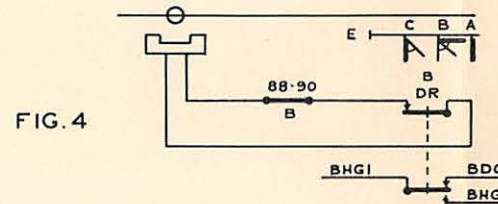


FIG. 4

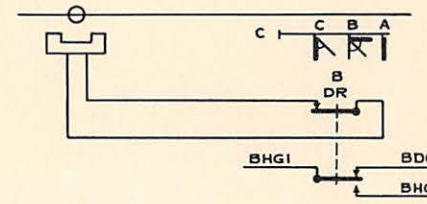


FIG. 5

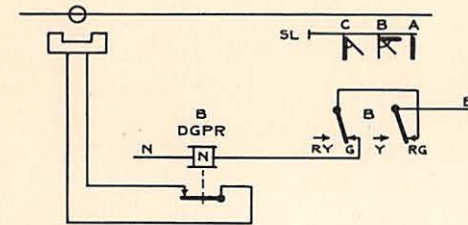


FIG. 6

FIG. 4 FIG. 5 & FIG. 6 = INDUCTOR CIRCUIT FOR CODE RULE 283 FIG. A. SIGNAL ALSO DISPLAYS CODE RULES 286, 290 FIG. A, 292 FIG. A

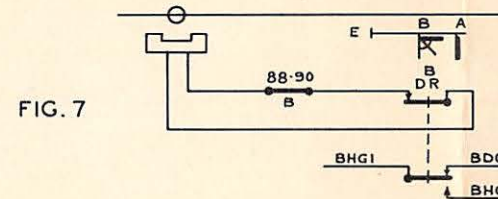


FIG. 7

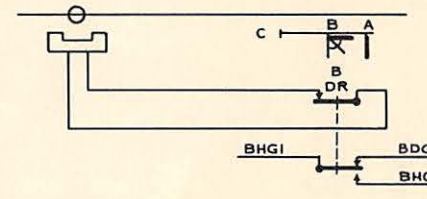


FIG. 8

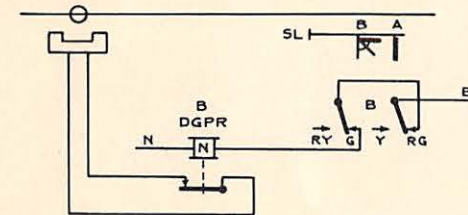


FIG. 9

FIG. 7 FIG. 8 & FIG. 9 = INDUCTOR CIRCUIT FOR CODE RULE 283 FIG. B. SIGNAL ALSO DISPLAYS CODE RULES 290 FIG. B, 292 FIG. B

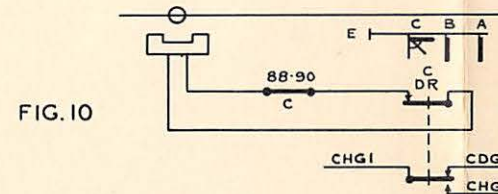


FIG. 10

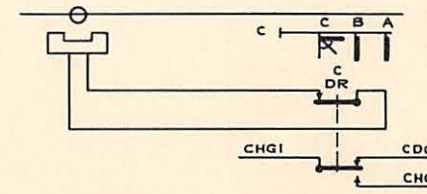


FIG. 11

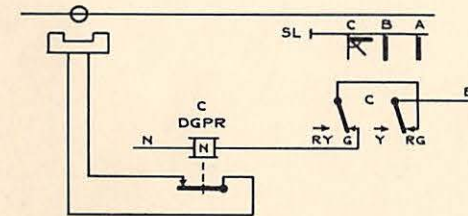
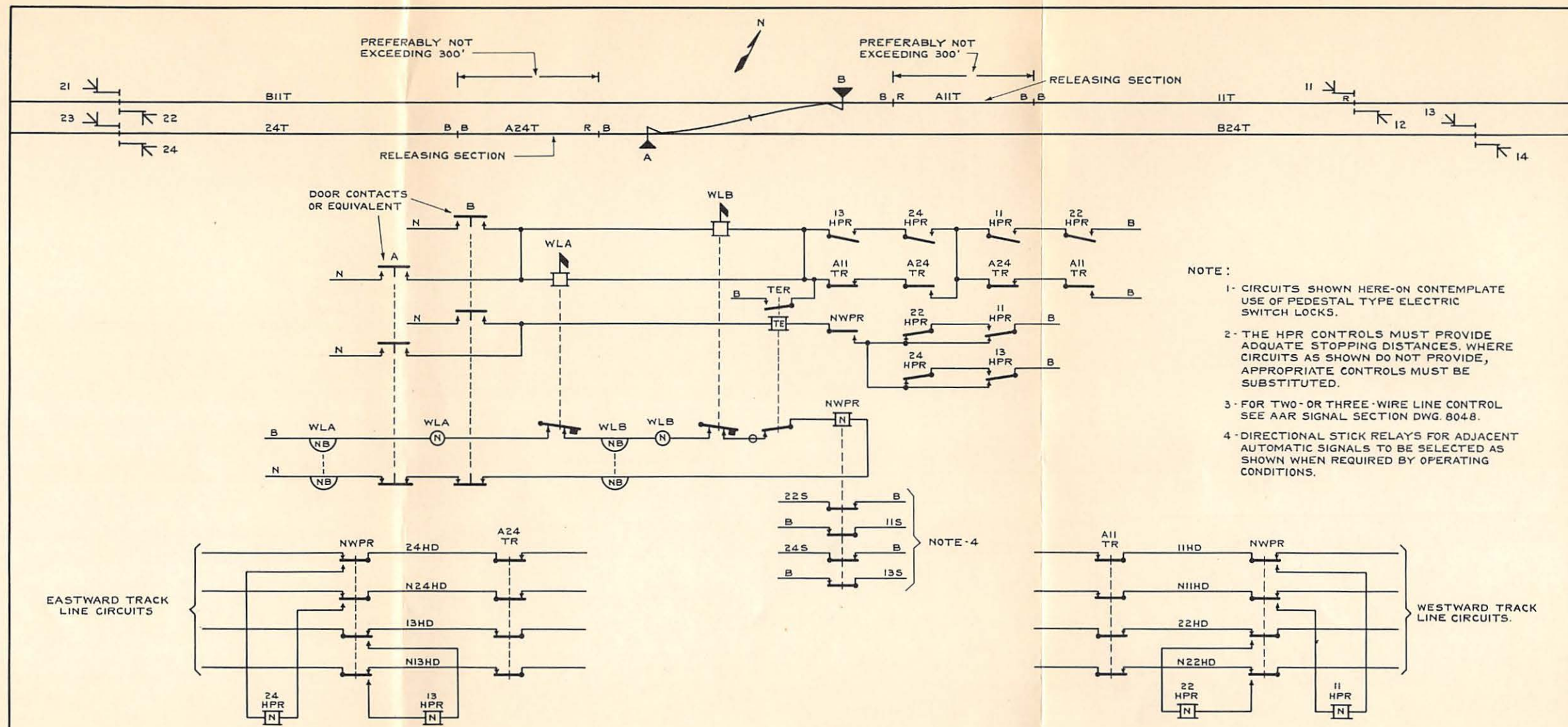


FIG. 12

FIG. 10 FIG. 11 & FIG. 12 = INDUCTOR CIRCUIT FOR CODE RULE 287 FIG. A. SIGNAL ALSO DISPLAYS CODE RULES 290 FIG. A, 292 FIG. A

WAYSIDE TRAIN STOP CIRCUITS

USING INTERMITTENT INDUCTIVE SYSTEM



ELECTRIC SWITCH LOCK CIRCUITS FOR CROSSOVER

TIME AND APPROACH LOCKING WITH AUTOMATIC CONTROL AND RELEASING TRACK SECTIONS
TRACKS SIGNALLED IN BOTH DIRECTIONS

Sept. 1953]

20. COMMITTEE X—SIGNALING PRACTICE. Prepare requisites for the various types of interlocking and block signaling systems, make recommendations having reference to the signal indications which should be given as the varied conditions on railroads require, also submit reports on such other matters as may be assigned by the Committee of Direction.
21. COMMITTEE XI—ELECTRONICS. Investigate and report on the use of electronics in connection with railway signal systems, interlocking, centralized traffic control, and highway grade crossing protection.
22. COMMITTEE XII—CIRCUIT DESIGN. Prepare typical circuits representative of approved practices and requisites for railroad signaling.
23. REPRESENTATION OF THE SECTION UPON GENERAL COMMITTEE OF THE ENGINEERING DIVISION: The five representatives of the Signal Section upon the General Committee of the Engineering Division shall be the Chairman, First Vice-Chairman, Second Vice-Chairman, and two members of the Committee of Direction to be selected by it.
24. RECOMMENDED PRACTICES:

Any definition, nomenclature, specification, recommended construction or recommended practice or any proposition having for its objective the formal declaration of the Section upon any matter of importance shall be presented in writing (accompanied by drawings if the latter are necessary for a clear understanding of the subject).

Such submissions will be presented to the Section at its Annual meeting for discussion, and following vote to decide whether or not the proposition shall be submitted to the voting members of Member Roads for adoption or rejection by letter ballot. If the vote to submit is affirmative, the Secretary within three months from the date of the meeting will distribute the ballots with a copy of the Minutes of the meeting, requesting their return within thirty days, naming the date. Ballots mailed after that date, as shown by the postmark, will not be counted. The Secretary shall announce the result of the ballot promptly to the Members. Ballots and envelopes shall be preserved for at least two years from date of announcement. The voting power of the Member Roads shall be as named in paragraph 26.

25. VOTING AT MEETINGS OF SECTION: Vote may be taken viva voce, by rising, by roll call or by ballot. Each Member Road shall be entitled to one vote, the ranking officer of a road present at any meeting being recognized as the voting representative of that road, unless otherwise designated by it. The vote of a majority of the Member Roads represented shall be required to decide any question, motion or resolution unless otherwise ordered, except that in the consideration of submitting a question to the letter ballot vote of the Member Roads, all representatives of Member Roads present at any meeting may vote. Thirty representatives of Member Roads shall constitute a quorum.

26. LETTER BALLOTS:

Letter ballots may be taken upon any subject by order of the Committee of Direction and *must* be taken on all questions affecting physical property. The voting power of the Member Roads shall be proportionate to ownership of signal equipment, one vote being counted for each

- 400 signals operating in two positions;
- 250 signals operating in three or four positions;
- 200 interlocked switches, power operated;
- 400 interlocked switches, manually operated;
- 250 highway crossings, automatically protected;
- 1600 train control inductors or loop circuits;
- 800 train control ramp (energized) magnet or coded circuits.

A fraction of a vote in the total of all items, if greater than one-half, shall be counted as one. Each Member Road shall have at least one vote.

Any proposition for which a majority of the votes are affirmative, shall be considered adopted.

27. ORDER OF BUSINESS: The order of business at meetings of the Section shall, unless otherwise directed by a majority of the members present, be as follows:

- Approval of Minutes of Last Meeting;
- Reports of Standing Committees;
- Reports of Special Committees;
- Unfinished Business;
- New Business.

28. Roberts' Rules of Order shall govern the proceedings of the Section, including amendment of these Rules of Order.

RESULT OF LETTER BALLOT ON SUBJECTS APPROVED AT THE ANNUAL MEETING, SEPTEMBER 29, 30 AND OCTOBER 1, 1952

All subjects have received the required affirmative letter ballot vote, as follows:

	For	Against
<i>Committee II—Interlocking</i>		
Specification 152-52—Electro-Pneumatic Switch Operating Mechanism. (Superseding Specification 152-50, Manual Part 30.)	1139	0
Specification 99-52—Electric Locks for Interlocking Machines. (Superseding Specification 99-46, Manual Part 96.)	1139	0
Specification 101-52—Electric Motor Switch Operating Mechanism. (Superseding sections 6-d-2 and 6-d-8 of Specification 101-50, Manual Part 104.)	1139	0
Specification 134-52—Electro-Mechanical Interlocking Machine. (Superseding Specification 134-43, Manual Part 193.)	1139	0

Committee IV—Automatic Block Signaling

Specification 83-52—Transformer, Dry Type Self-Cooled. (Superseding Specification 83-44, Manual Part 164.)	1117	0
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Committee V—Contracts and Instructions

Definitions for Technical Terms Used in Signaling. (To be included in Manual Part 55.)	1139	0
Specification 112-52—Portable Alternating Current Ammeter. (Superseding Specification 112-46, Manual Part 3.)	1139	0
Instructions for Made Grounds. (Superseding Instructions for Resistance of Made Grounds, Manual Part 61.)	1139	0
Specification 85-52—Portable Direct Current Voltmeters, Ammeters and Volt-Ammeters. (Superseding Specification 85-46, Manual Part 168.)	1139	0
Specification 115-52—Portable Alternating Current Voltmeter. (Superseding Specification 115-46, Manual Part 169.)	1139	0
Instructions for Electric Switch Locks. (New.)	1139	0
Instructions for Track Circuits. (Superseding Instructions for Non-Coded Direct Current Track Circuits, Manual Part 8; Instructions for Non-Coded Alternating Current Track Circuits, Manual Part 162, and Instructions for Coded Direct Current Track Circuits, Manual Part 218.)	1139	0
Instructions for Copper-Oxide Caustic Soda Primary Cells. (Superseding Instructions for Copper-Oxide Caustic Soda Primary Cells, Manual Part 7.)	1139	0
Instructions for Car Retarder Systems. (Superseding Instructions for Car Retarder Systems, Manual Part 125.)	1139	0

	For	Against
<i>Committee V—Contracts and Instructions—Continued</i>		
Instructions for Insulation Resistance. (Superseding Instructions for Insulation Resistance, Manual Part 130.).....	1139	0
Instructions for Facing Point Locks Applied to Spring Switches. (Superseding Instructions for Facing Point Locks Applied to Spring Switches, Manual Part 159.).....	1139	0

Committee VI—Designs

A.A.R. Sig. Sec. 1055E—Switch-Rod Insulation. (Superseding A.A.R. Sig. Sec. 1055D in the Manual.).....	1139	0
A.A.R. Sig. Sec. 1245B—Pinnacles—For 4-5-6 and 8 Inch Mast—Details and Assemblies. (Superseding A.A.R. Sig. Sec. 1245A in the Manual.).....	1139	0
A.A.R. Sig. Sec. 1271B—Ball Studs—For Switch Circuit Controller—Details and Assemblies. (Superseding A.A.R. Sig. Sec. 1271A in the Manual.).....	1139	0
A.A.R. Sig. Sec. 1272B—Ball Socket Screw Jaw—For Switch Circuit Controller—Details and Assembly. (Superseding A.A.R. Sig. Sec. 1272A in the Manual.).....	1117	22
A.A.R. Sig. Sec. 1364E—Ladder Platforms—Details and Assemblies. (Superseding A.A.R. Sig. Sec. 1364D in the Manual.).....	1139	0
A.A.R. Sig. Sec. 1399D—Low Target Stand—Details and Assembly. (Superseding A.A.R. Sig. Sec. 1399C in the Manual.).....	1139	0
A.A.R. Sig. Sec. 1447B—Base for 5 Inch Mast—For Heavy Loading. (Superseding A.A.R. Sig. Sec. 1447A in the Manual.).....	1139	0
A.A.R. Sig. Sec. 1463B—Cross-Arm for Extended Lights—For Flashing Light Highway Crossing Signal with Pedestal Mounted Gate—Assembly. (Superseding A.A.R. Sig. Sec. 1463A in the Manual.).....	1139	0
A.A.R. Sig. Sec. 1468B—Cross-Arm for Suspended Lights—For Flashing Light Highway Crossing Signal with Mast Mounted Gate—Assemblies. (Superseding A.A.R. Sig. Sec. 1468A in the Manual.).....	1139	0
A.A.R. Sig. Sec. 1489F—Highway Crossing Signal—Flashing Light Type with Suspended Lights and Mast Mounted Gate—Assembly. (Superseding A.A.R. Sig. Sec. 1489E in the Manual.).....	1139	0
A.A.R. Sig. Sec. 1491E—Highway Crossing Gate Roadway Arm—For Mast Mounting. (Superseding A.A.R. Sig. Sec. 1491D in the Manual.).....	1139	0
A.A.R. Sig. Sec. 1492B—Highway Crossing Gate Sidewalk Arm—For Mast Mounting. (Superseding A.A.R. Sig. Sec. 1492A in the Manual.).....	1139	0

	For	Against
<i>Committee VI—Designs—Continued</i>		
A.A.R. Sig. Sec. 1647E—Single Adapter Clamp—For Signs—4 to 8 Inch Pipe—Details. (Superseding A.A.R. Sig. Sec. 1647D in the Manual.)	1139	0
A.A.R. Sig. Sec. 1656E—Cross-Arm for Suspended Lights—For Flashing Light Highway Crossing Signals Without Gates—4 to 8 Inch Pipe—Assemblies. (Superseding A.A.R. Sig. Sec. 1656D in the Manual.)	1139	0
A.A.R. Sig. Sec. 1657E—Cross-Arms—For Flashing Light Highway Crossing Signals—4 to 8 Inch Pipe—Details. (Superseding A.A.R. Sig. Sec. 1657D in the Manual.)	1139	0
A.A.R. Sig. Sec. 1696B—Extension Brackets for Crossing Signs. (Superseding A.A.R. Sig. Sec. 1696A in the Manual.)	1139	0
A.A.R. Sig. Sec. 1542B—Incandescent Electric Lamps—Bases. (Superseding A.A.R. Sig. Sec. 1542A in the Manual.)	1139	0
A.A.R. Sig. Sec. 1471A—Junction Box Base for 5 Inch Mast—For Heavy Loading—Assembly. (New.)	1139	0
A.A.R. Sig. Sec. 1472A—Junction Box Base for 5 Inch Mast—For Heavy Loading—Details. (New.)	1139	0
A.A.R. Sig. Sec. 1513A—Take or Leave Siding Roundel—For Illuminated Indicator. (New.)	1139	0
A.A.R. Sig. Sec. 1514A—Electric Light Unit—For Indicators and Signs. (New.)	1139	0
A.A.R. Sig. Sec. 1515A—Illuminated Indicators and Signs—Front of Mast Mounting for 4 to 8 Inch Pipe. (New.)	1139	0
A.A.R. Sig. Sec. 1516A—Illuminated Indicators and Signs—Side of Mast Mounting for 4 to 8 Inch Pipe. (New.)	1139	0
Specification 51-52—Incandescent Electric Lamps. (Superseding Specification 51-49, Manual Part 91.)	1139	0
Specification 231-52—Illuminated Indicators and Signs. (Superseding Specification 231-50, Manual Part 237.)	1139	0

Committee VII—Materials Research

Specification 200-52—Aluminum Paint (Ready-to-Mix). (Superseding Specification 200-43, Manual Part 62.)	1117	0
Specifications 120-52—Painting. (Superseding sections 5-a-2 and 8 of Specification 120-51, Manual Part 110.)	1117	0
Specification 259-52—Aluminum Paint (Ready-Mixed). (New.)	1139	0
Specification 13-52—Hard Fibre. (Superseding Specification 13-39, Manual Part 58.)	1139	0
Requisites for Fabricated Fibre Parts for Track Insulation. (New.)	1139	0
Specification 77-52—Impedance Bond Compound. (Superseding Specification 77-41, Manual Part 111.)	1139	0
Specifications for Various Types of Non-Ferrous Metals and Alloys. (Superseding Specifications for Various Types of Non-Ferrous Metals and Alloys, Manual Part 220.)	1139	0

	For	Against
<i>Committee VII—Materials Research—Continued</i>		
Specification 217-52—Impedance Bond Oil. (Superseding Specification 217-46, Manual Part 222.).....	1139	0
Specification for Signal Colors Exclusive of Signal Glasses. (Superseding Specification for Signal Colors Exclusive of Signal Glasses, Manual Part 273.).....	1139	0

<i>Committee VIII—Highway Grade Crossing Protection</i>		
Specification 176-52—Automatic Highway Grade Crossing Signals and Devices. (Superseding Specification 176-41, Manual Part 149, and Specification 209-50, Manual Part 179.).....	1139	0
Signs Used in Connection with Manually Protected Railroad-Highway Grade Crossings. (Superseding Signs Used in Connection with Manually Protected Railroad Highway Grade Crossings, and Advance Warning Signs, Manual Part 269.).....	1139	0

<i>Committee IX—Wire and Cable</i>		
Specification 91-52—Lead Sheathed Cable, Non-Armored. (Superseding title of Specification 91-50, Manual Part 28.).....	1139	0
Specification 145-52—Lead Sheathed Cable, Armored. (Superseding title and sections 1-a and 11-a of Specification 145-50, Manual Part 20.).....	1139	0
Specification 90-52—Lead Sheathed Cable, Submarine. (Superseding title of Specification 90-50, Manual Part 26.).....	1139	0
Specification 240-52—Polychloroprene Sheathed Cable. (Superseding title and section 7-a-1 of Specification 240-50, Manual Part 249.).....	1139	0
Specification 161-52—Polychloroprene Sheathed Cable with Outer Covering. (Superseding title and section 1-a of Specification 161-50, Manual Part 36.).....	1139	0
Specification 89-52—Braid-Covered Cable. (Superseding title of Specification 89-50, Manual Part 25.).....	1139	0
Specification 111-52—Insulated Wire. (Superseding title, sections 1-a, 7-a and alternate requisites section R-7-a of Specification 111-50, Manual Part 186.).....	1139	0
Specification 192-52—Insulated Wire, A.V.C. (Superseding title and section 1-a of Specification 192-40, Manual Part 187.).....	1139	0
Specification 169-52—Copper Line Wire. (Superseding title and section 1-a of Specification 169-48, Manual Part 182.).....	1139	0
Specification 168-52—Copper Alloy Line Wire. (Superseding title and section 1-a of Specification 168-48, Manual Part 173.).....	1139	0

	For	Against
<i>Committee IX—Wire and Cable—Continued</i>		
Specification 167-52—Copper-Covered Steel Line Wire. (Superseding title and section 1-a of Specification 167-48, Manual Part 180.).....	1139	0
Specification 196-52—Copper-Bearing Steel Line Wire. (Superseding title and section 1-a of Specification 196-48, Manual Part 181.).....	1139	0
Specification 108-52—Copper Bond Wire. (Superseding sections 1-a and 2-a of Specification 108-47, Manual Part 175.)	1139	0
Specification 70-52—Copper-Covered Steel Bond Wire. (Superseding title and sections 1-a and 2-a of Specification 70-47, Manual Part 176.).....	1139	0
Wire Inspection Report. (To be removed from Manual Part 178.).....	1139	0
Specification 22-52—Galvanized E.B.B. Steel Bond Wire. (Superseding sections 1-a and 2-a of Specification 22-46, Manual Part 177.).....	1139	0
Specification 54-52—Aluminum Cable Steel Reinforced Line Wire. (Superseding title and section 1-a of Specification 54-39, Manual Part 24.).....	1139	0
Specification for Vitrified Clay Conduit. (To be removed from Manual Part 41.).....	1139	0

Committee X—Signaling Practice

Requisites for Traffic Control Systems. (Superseding Requisites for Centralized Traffic Control, Manual Part 86.).....	1139	0
Signaling for Gravity Classification Yards. (Superseding Signaling for Gravity Classification Yards, Manual Part 42.)	1139	0

RULES OF ORDER

Effective April 6, 1938

Revised: December 6, 1938; May 22, 1940; March 12, 1941; May 17, 1944;
December 11, 1946; June 8, 1949; May 7, 1952.

1. **REPRESENTATIVES:** The representatives of Member Roads in the Signal Section shall be employees engaged in an official or supervisory capacity in the design, construction or maintenance of railroad signaling devices. Included within this category shall be Signal Superintendents, Signal Engineers and their Assistants, Signal Inspectors, Chief Draftsmen, Signal Supervisors and Assistant Signal Supervisors, or others with corresponding duties.
2. **AFFILIATED MEMBERS:**
 - (a) **RAILROAD AFFILIATED MEMBERS:** A member of a State or Federal regulatory body, or a railroad employee not embraced within the provisions of paragraph 1 (including those temporarily relieved from service or furloughed) may become a **RAILROAD AFFILIATED MEMBER** upon approval of his application by the Committee of Direction. Such a member will pay an annual fee of \$3.00 (which may be changed from year to year at the discretion of the Committee of Direction), on January 1st of each year, for which he will receive currently the Advance Notices and Minutes of the Section.
 - (b) **AFFILIATED MEMBERS:** A representative of an organization or an individual engaged in the design, manufacture, sale or construction of signal devices or materials applicable thereto, or one who is qualified by his business relations and practical experience to cooperate with the Section, may become an **AFFILIATED MEMBER** thereof upon approval of his application by the Committee of Direction. An Affiliated Member will pay an annual fee of \$6.00 (which may be changed from year to year at the discretion of the Committee of Direction), on January 1st of each year, for which he will receive currently the Advance Notices and Minutes of the Section.
 - (c) A Railroad Affiliated or an Affiliated Member shall have the rights and privileges accorded a Member Road representative except voting or the holding of office.
 - (d) A Railroad Affiliated or an Affiliated Member may be appointed as a Consulting Member of any Standing Committee upon the approval of the Committee of Direction.
3. **LIFE MEMBERS:** Life membership may be conferred upon members who retire from active work. They shall have been active in the affairs of the Signal Section and its predecessors and their total term of membership shall have been not less than twenty-five years. Their rights and privileges shall be continued without change. A proposal to confer Life Membership must be signed by five voting representatives of Member Roads and five representatives of Member Roads, stating their reason for

making such proposal. Proposal shall be duly considered at a meeting of the Committee of Direction and then submitted to a vote by letter to the Committee of Direction membership for approval.

Officers and Committees

4. The Officers of the Section shall consist of a Chairman, First Vice-Chairman, Second Vice-Chairman, and Secretary.

- (a) The Chairman and Vice-Chairmen shall be selected by the Committee of Direction on or before November 1st. Their terms of office shall be one year from January 1st or until their successors are selected and qualified. A Chairman or Vice-Chairman having served a full term shall not succeed himself.
- (b) The Secretary will be appointed by the Committee of Direction. His salary shall be named by that Committee subject to the approval of the Vice-President, Operations and Maintenance Department of the Association.
- (c) The COMMITTEE OF DIRECTION will consist of twelve members, as follows: The Chairman, the First Vice-Chairman, the Second Vice-Chairman, the latest Past Chairman, one member from New England or Canada, three members from the East, one member from the South and three members from the West.

The territorial representatives, except when filling vacancies, shall serve four years and their term of office will expire on December 31st of the fourth year.

Vacancies in official positions or of territorial representatives shall be filled until the next election, by the Committee of Direction.

One Vice-Chairman shall be selected from Eastern Territory and one from Western Territory. For this purpose the Eastern Territory will consist of all territory operating under Eastern and Atlantic Standard Time. All other territory will be known as Western Territory. The location of the official's headquarters will determine whether he is in the Eastern or Western territory.

- (d) The Standing Committees of the Section will be as follows:

- I—Economics of Railway Signaling
- II—Interlocking
- III—Signal Shop Practice
- IV—Automatic Block Signaling
- V—Contracts and Instructions
- VI—Designs
- VII—Materials Research
- VIII—Highway Grade Crossing Protection
- IX—Wire and Cable
- X—Signaling Practice
- XI—Electronics
- XII—Circuit Design

The representation of Member Roads on these committees will be, when practicable, territorially selected, in approximately the same proportion as that of the Committee of Direction, the personnel to be named each year by the Committee of Direction.

Duties of Officers

5. The CHAIRMAN shall have general supervision over the affairs of the Section and shall preside at meetings of the Section and at meetings of the Committee of Direction.
6. The FIRST VICE-CHAIRMAN, in the absence of the Chairman, shall perform the duties of the Chairman. He shall perform such other duties as may be assigned to him by the Chairman.
7. The SECOND VICE-CHAIRMAN, in the absence of both the Chairman and First Vice-Chairman, shall perform the duties of the Chairman. He shall perform such other duties as may be assigned to him by the Chairman.
8. (a) The SECRETARY shall devote his entire time to the work of the Section and will perform the usual duties of that office and such other duties as may be assigned to him by the Chairman.
(b) He shall receive on or before November 20th of each year the report of the Committee on Nominations, as elsewhere provided for, and will submit to the voting representatives of Member Roads, not later than November 29th, for letter ballot vote, the nominations contained in that report, to fill the vacancies in the membership of the Committee of Direction. He shall appoint three Tellers from representatives of Member Roads to assist him in counting the ballots, who shall certify the count thereof, with him, to the Committee of Direction. He shall announce the result of the ballot to the Members promptly.
(c) He shall furnish, free of charge, to each representative of a Member Road, designated by such road, one copy of all circulars, Advance Notices and Minutes.
(d) He shall furnish to each Railroad Affiliated, Affiliated and Life Member one copy of all circulars, Advance Notices and Minutes.

Duties of Committees

9. The COMMITTEE OF DIRECTION shall:
 - (a) Exercise general supervision over the interests and affairs of the Section.
 - (b) Be empowered to act on behalf of the Section in the interim between meetings and submit at each meeting a report covering its actions.
 - (c) Examine and decide what portion of communications, papers and reports shall be submitted to the meetings. It shall determine which, if any, of the subjects presented by the various committees shall be referred to the General Committee of the Engineering Division.
 - (d) Appoint on or before October 1st of each year a Committee on Nominations consisting of representatives of five Member Roads, who shall not be members of the Committee of Direction.
 - (e) Appoint additional committees as required.

- (f) Submit to the Vice-President, Operations and Maintenance Department, detail of contemplated financial requirements for conducting the work of the Section as required or as called for by that official.
 - (g) Call Annual meetings of the Section if in its judgment conditions warrant.
 - (h) Call meetings of the Section upon not less than thirty days' notice to each member. It **MUST** call a special meeting of the Section upon the request in writing of a majority of the voting members of Member Roads.
 - (i) Publish Manual of Recommended Practice, in which shall be included such approved Specifications, Drawings, Findings and Conclusions of the Section as the Committee of Direction may find advisable.
10. The **COMMITTEE ON NOMINATIONS**, appointed as prescribed above, shall report to the Secretary on or before November 20th each year at least two nominations for each impending vacancy to replace the territorial representatives on the Committee of Direction.
- The duties of the Standing Committees shall be as follows:
- 11. **COMMITTEE I—ECONOMICS OF RAILWAY SIGNALING.** Study and report on the economy, if any, of the various signal systems, interlocking, train control, cab signals and other signaling projects.
 - 12. **COMMITTEE II—INTERLOCKING.** Prepare specifications for the various types of interlockings and submit reports on subject-matters relating thereto.
 - 13. **COMMITTEE III—SIGNAL SHOP PRACTICE.** Study and report on signal shop practices.
 - 14. **COMMITTEE IV—AUTOMATIC BLOCK SIGNALING.** Prepare specifications for the various types of automatic block systems and submit reports on subject-matters relating thereto.
 - 15. **COMMITTEE V—CONTRACTS AND INSTRUCTIONS.** Prepare recommended forms for use in connection with signaling contracts and prepare instructions relating to signal maintenance.
 - 16. **COMMITTEE VI—DESIGNS.** Prepare detailed drawings for standardization purposes and make any special study or investigation assigned to it by the Committee of Direction.
 - 17. **COMMITTEE VII—MATERIALS RESEARCH.** Make such investigation of materials used in connection with signaling as directed by the Committee of Direction and submit reports on its conclusions.
 - 18. **COMMITTEE VIII—HIGHWAY GRADE CROSSING PROTECTION.** Prepare requisites for highway grade crossing protection and submit matters of interest relating thereto.
 - 19. **COMMITTEE IX—WIRE AND CABLE.** Prepare specifications for wire and cable, overhead and underground lines and any recommendations relating thereto which will be of interest to the Section.

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SIGNAL SECTION, A.A.R.

ADVANCE NOTICE

September 28, 29 and 30, 1953

CIRCULAR NO. S.S. 290

ASSOCIATION OF AMERICAN RAILROADS
Operations and Maintenance Department
Engineering Division
Signal Section
59 E. Van Buren Street
Chicago 5, Ill.

J. H. AYDELOTT
Vice-President
Operations and Maintenance
Department

Officers of Section
R. W. Troth, Chairman
W. N. Hartman, First Vice-Chairman
T. W. Hays, Second Vice-Chairman
R. H. C. Balliet, Secretary

June 25, 1953

PULLMAN RATES

Dear Sir:

In connection with the 55th Annual Meeting of the Signal Section to be held in St. Louis, Mo., September 28, 29 and 30, 1953, the Pullman Company has extended to railroad members of the Section and dependent members of their ~~families~~ lawfully entitled thereto, the courtesy of half-rate privileges incident to the use of standard car accommodations to and from the meeting via reasonably direct routes, under the following plan:

Full fares to be paid, both going and returning, and one-half of total amount paid for sleeping and parlor car accommodations to be refunded after member's return home.

Applications for refund must be made on attached form. Extra copies of the form will be available at the Registration Desk at the meeting.

The Pullman Company advises that under its regulations, as well as under the regulations adopted by railroad executives concerning the issuance of passes and half-rate fares, it is necessary for each application for refund to be supported by the following:

1. PASSENGER'S CHECK OF PULLMAN TICKETS, DULY RECEIPTED BY ISSUING AGENT, SHOWING POINTS OF ORIGIN AND DESTINATION, THE DATE USED, AMOUNT OF MONEY PAID, AND THE NAME OF THE PURCHASER. (THE PULLMAN STUB MAY BE RECEIPTED ON REVERSE SIDE OR SEPARATE RECEIPT MAY BE ATTACHED TO THE STUB - WHEN SEPARATE RECEIPT IS ISSUED, STUB MUST ACCOMPANY SAME.) OR
2. CASH FARE CHECKS OF PULLMAN CONDUCTOR SHOWING POINTS OF ORIGIN AND DESTINATION, THE DATE USED, AMOUNT OF MONEY PAID, AND THE NAME OF THE PURCHASER, AND
3. FORMAL REQUEST, FROM PASS BUREAU OF MEMBER'S OWN RAILROAD (IN CONFORMITY WITH PRESENT REGULATIONS).

After being completely filled out and signed, application for refund, with the several required supporting documents, must be forwarded to the Secretary of the Signal Section at Room 2205, 59 E. Van Buren St., Chicago 5, Ill., for certification and transmittal to the Pullman Company.

Respectfully,

R. H. C. Balliet
Secretary
Signal Section

ASSOCIATION OF AMERICAN RAILROADS
SIGNAL SECTION

t5119-2

(Date) _____, 1953

Mr. J. J. Nolan, Vice-President, Traffic
The Pullman Company
Merchandise Mart Plaza
Chicago 54, Illinois

Dear Sir:

I certify that I am a member of the above named organization and am employed as _____ by _____ R.R. and that the standard
(Occupation) (Carrier)
car accommodations described below were occupied by myself or dependent members of my family, as follows:

(Name)	(Relationship)
while en route to or returning from the meeting of the Signal Section held in St. Louis, Mo., on September 28, 29 and 30, 1953, as evidenced by the attached:	

1. Passenger's check of tickets or conductor's cash fare checks showing points of origin and destination, date used, amounts paid, and receipted on back to show my name as purchaser. (When separate receipt is issued, Pullman stub must accompany same.)

FROM	TO	ACCOMMODATIONS	AMOUNT PAID

TOTAL _____

I am not, nor are the dependent members of my family who accompanied me, prohibited by law from receiving reduced rates for sleeping or parlor car accommodations, and request is hereby made for refund of one-half of the amounts paid for the accommodations furnished in standard cars of the Pullman Company, as shown, and as covered by the accompanying:

1. Request, in regular form, from Pass Bureau of member's own railroad (in conformity with present regulations).

Yours truly,

ATTEST:

I certify that the applicant named is a member and attended the above mentioned meeting.

NAME _____

(Signature of applicant)

ADDRESS _____

Secretary _____

REFUND WILL NOT BE MADE UNLESS THIS FORM OF APPLICATION TOGETHER WITH PASSENGER'S CHECKS RECEIPTED AS DESCRIBED ABOVE, AND FORMAL REQUEST FROM PASS BUREAU, ARE FORWARDED TO THE PULLMAN COMPANY THROUGH THE OFFICE OF THE SECRETARY OF THE SIGNAL SECTION AND ATTESTED BY HIM AS PROVIDED HEREON.

CIRCULAR NO. S.S. 289

ASSOCIATION OF AMERICAN RAILROADS
Operations and Maintenance Department
Engineering Division
Signal Section

59 E. Van Buren Street
Chicago 5, Illinois

J. H. AYDELOTT
Vice-President
Operations and Maintenance
Department

Officers of Section
R. W. Troth, Chairman
W. N. Hartman, First Vice-Chairman
T. W. Hays, Second Vice-Chairman
R. H. C. Balliet, Secretary

June 25, 1953

TO SIGNAL SECTION MEMBERS:

As advised in Circular No. S.S. 288, dated January 8, 1953, the 55th Annual Meeting of the Signal Section, Association of American Railroads, will be held in St. Louis, Mo., on Monday, Tuesday and Wednesday, September 28, 29 and 30, 1953. Sessions will convene in the Chase Club at the Chase Hotel at 9:30 a.m., C.S.T. Exhibits will be held in rooms adjoining the Chase Club at the Chase Hotel.

If you are planning to attend the meeting and have not as yet reserved sleeping accommodations, it is suggested you immediately do so, addressing Mr. Bob Ross, the Chase Hotel, 212 N. Kingshighway Blvd., St. Louis 8, Mo.

The Annual Dinner will be held Tuesday evening, September 29 - dress optional.

The Advance Notice containing reports of the committees to be presented at the meeting is enclosed herewith. Suggestions or criticisms on any of the reports therein should be submitted in writing to the respective committee chairmen by not later than August 28, 1953.

Respectfully,

R. W. Troth
Chairman

R. H. C. Balliet
Secretary

CIRCULAR NO. S.S. 292

ASSOCIATION OF AMERICAN RAILROADS
Operations and Maintenance Department
Engineering Division
Signal Section59 E. Van Buren Street
Chicago 5, IllinoisJ. H. AYDELOTT
Vice-President
Operations and Maintenance
DepartmentOfficers of Section
R. W. Troth, Chairman
W. N. Hartman, First Vice-Chairman
T. W. Hays, Second Vice-Chairman
R. H. C. Balliet, Secretary

June 25, 1953

TO SIGNAL SECTION MEMBERS:

Cloth Bound Volume XLIX, 1951 Proceedings, containing committee reports, minutes, etc., for the 1951 fiscal year, is now on sale.

If you desire a copy of this volume, which sells at \$4.00 per copy to members, filling out and returning the blank below will constitute an order. If a requisition is sent covering the book, the blank should not be returned.

Unless copies are ordered by railroad requisition, a remittance made payable to the Association of American Railroads should accompany order.

Respectfully yours,

R. H. C. Balliet

Secretary
Signal Section

(Date) _____

R. H. C. Balliet, Secretary
Signal Section, Association of American Railroads
59 E. Van Buren St.
Chicago 5, Ill.

Please accept my order for cop of Bound Volume XLIX.

Name (Please print) _____

Title _____

Company _____

Address _____